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Gardner (K.) & Heath (D. F.). **Quantitative Determination of Isomers of O,O-Diethyl Ethylmercaptoethyl Thiophosphate.**—*Analyt. Chem.* **25** pp. 1849–1853, 3 graphs, 22 refs. Easton, Pa., 1953.

Pure O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate, prepared in the laboratory, showed lower toxicity to insects and mammals than the active constituent of the insecticide Systox, which is stated to be this compound, and differed from it in physical properties. Since many compounds of the S=P–O– type, such as parathion, are known to be thermally unstable [*cf. R.A.E.*, A **40** 327; **41** 358], it was presumed that the discrepancies were due to partial isomerisation of the commercial product. Radioactive samples of pure O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate and O,O-diethyl S-2-(ethylmercapto)ethyl thiophosphate in commercial preparatherefore prepared. A sample of the first was heated to a temperature of 130–145°C. for 2½ hours, and subsequent subjection to a sequence of successive partitioning between iso-octane and a mixture of methanol and water (9:1) showed that both compounds were then present, owing to partial isomerisation. Concurrent partial chromatography on a kieselguhr methanol iso-octane column of a mixture of the two radioactive compounds and the active ingredient isolated from Systox, with estimation of the radioactive phosphorus and total phophorus in the eluent fractions, showed that both compounds were present in Systox.

A slight modification of the chromatographic method was developed for the analysis of O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate and O.O-diethyl S-2-(ethylmercapto)ethyl thiophosphate in commercial preparations. Such a technique is useful for the analysis of compounds of the S=P–O– type, some of which are difficult to prepare in a state of high purity owing to their thermal instability. In particular, the technique of concurrent partition chromatography of an unknown sample with radioactive compounds of established structure and purity may find more general application in the identification of isomers of the S=P–O– and O=P–S– types.

Analyses of the commercial products Systox and Bayer 8169 [*cf.* **41** 436] showed that the first contained about 15 per cent. each of O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate and O,O-diethyl S-2-(ethylmercapto) ethyl thiophosphate, and the second 18 and 30 per cent. of the two isomers, respectively. The presence of such high proportions of the S-isomer, which is about ten times as toxic to mammals and insects as the O-isomer, adequately explains the insecticidal and toxicological properties of such products.

Ledbetter (M. C.) & Flemion (F.). **A Method for obtaining piercing-sucking Mouth Parts in Host Tissue from the Tarnished Plant Bug by High Voltage Shock.**—*Contr. Boyce Thompson Inst.* **17** no. 6 pp. 343–346, 2 figs., 8 refs. Yonkers, N.Y., 1954.

Flemion (F.), Ledbetter (M. C.) & Kelley (E. S.). **Penetration and Damage of Plant Tissues during Feeding by the Tarnished Plant Bug** (*Lygus lineolaris*).—*T.c.* pp. 347–357, 4 figs., 20 refs.

In the first of these papers, the authors describe a method by which an electric current is used to stun or kill adults of *Lygus lineolaris* (P. de B.) with their stylets inserted in plant tissue, so that these can be cut off and their positions studied.

In the second, the mechanism of feeding is described from microscopic examination of such stylets and from motion-picture films of the movements of the stylets in the plant tissue; the following is taken from the authors'

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summary. The stylets not only moved rapidly when in plant tissues in search of food, but frequently plunged into and withdrew from the tissue, travelled in various directions and followed no particular path. Photomicrographs of histological material showed that the stylets penetrated the various tissues of bean pods and travelled intro- as well as intercellularly. In several instances, the stylets entered the bean pod by piercing the epidermis adjacent to the guard cells of a stoma. Studies on mode of entry and travel in parsnip fruits indicated that the stylets readily pass through the various structures of these fruits. Histological studies of the breakdown of bean-pod and fennel-leaf tissue after feeding revealed that many cells in the feeding area were affected. Some had collapsed, and others were in various stages of disorganisation.

Kemp (H. K.). **Codling Moth and DDT.**—*J. Dep. Agric. S. Aust.* **56** no. 12 pp. 558–561, 566, 1 graph. Adelaide, 1953.

A severe outbreak of the codling moth [*Cydia pomonella* (L.)] occurred in an apple orchard in South Australia in 1952–53, although it had received eight well-timed applications of DDT, at concentrations of 0·075 and 0·1 per cent. p,p′DDT, and lead arsenate between early November and late March. The outbreak is attributed to the entry of females in search of oviposition sites from an adjoining unsprayed orchard from which a very small crop had been stripped and to poor persistence of the DDT residues in hot weather. The procedure to be adopted when spraying with DDT against *C. pomonella* to prevent such an occurrence is reviewed, with the modifications in the spray schedule necessary for the control of the light-brown apple moth [*Tortrix postvittana* (Wlk.)] and the mite, *Bryobia* [*praetiosa* Koch]. Lure pots baited with wine or molasses [*cf. R.A.E.*, A **39** 134] should be used in orchards thoughout the spraying period as indicators of the continued effectiveness of the spray deposit, and spraying repeated when moths are taken in them. Orchards not in bearing should be sprayed at least twice. *T. postvittana* is readily controlled by the inclusion in the DDT spray, especially in the early applications, of 1–2 lb. lead arsenate per 100 gals., and *Bryobia* by the addition of white oil at 1:60 or 1:80 [*cf.* **36** 246].

Forte (P. N.) & Greaves (T.). **New Insecticides for the Control of the Argentine Ant in Western Australia.**—*J. Dep. Agric. W. Aust.* (3) **2** no. 2 pp. 267–269, 271–273, 275–277, 279–280, 9 figs., 6 refs. Perth, W.A., 1953.

Earlier work in Western Australia showed that although DDT gives effective control of *Iridomyrmex humilis* (Mayr) [*cf. R.A.E.*, A **39** 33], it is of no value for large-scale eradication, and since chlordane had proved satisfactory against this ant in experiments in New South Wales [**42** 45], it was used in comparative tests in two suburbs of Perth during 1951–52. The insecticides were applied as barrier sprays in a grid pattern as in New South Wales. In the first experiment, in which 1 and 2 per cent. chlordane, 2 per cent. DDT and a mixture of 1 per cent. of each insecticide were applied in February 1951 round single household plots at an average rate of 60 gals. per acre, the results were invalidated by invasion from outside the experimental area and no significant difference was found between treatments, though chlordane appeared superior to DDT; the method of assessment by the numbers of ants in trails in standard positions [**42** 45] was also unsatisfactory, since many infested sites showed no trails. In another test, 2 per cent. chlordane was sprayed at 60 gals. per acre round a block of nine houses and a bakery surrounded by tarred roads, also in February

1951, and the ants were eradicated by July. In the following month, the edges of the block were invaded from outside; these areas were accordingly re-treated, and buffer strips round the block were sprayed then and again in November and in March 1952, when the area was once more free from infestation.

In a further experiment on the possibility of eradication, the same four sprays were applied in August 1951 round blocks of houses surrounded by tarred roads or lanes and in barrier strips, 10 ft. apart, forming grids over the lawns and drives at rates of about 24–45 gals. per acre, and 2 per cent. chlordane and the combined spray were also used in a simplified treatment at about 20–35 gals. per acre in some blocks, where the barrier strips were spaced 15 ft. apart. In addition, buffer areas on the side of the street opposite to that bounding the experimental blocks were treated by spraying the kerb, the bases of trees to a height of 6 ft. and both sides of the foot-paths, with cross sprays every 10 ft. No attempt was made to clear vegetation or destroy rubbish prior to treatment. Ants were still present after 26 weeks, but a further application was then made at rates up to 20 gals. per acre higher than before. Eight weeks later, the ants had been eradicated from the block treated with 2 per cent. chlordane and greatly reduced in the other blocks that received chlordane alone; control from DDT was poor. In a subsidiary test, one application of emulsified solutions containing 2 per cent. dieldrin, aldrin or chlordane as barrier sprays at rates of 52–54 gals. per acre in August 1951 gave complete control after 9, 13 and 21 weeks, respectively, in blocks of houses that were previously very heavily infested.

The 2 per cent. chlordane spray was of no value, however, even at a rate of 100 gals. per acre, in eradicating *I. humilis* from experimental plots in a heavily infested swamp area in which there was abundant food for the ants. Subsequent observations showed that, owing to the favourable conditions, the ants made only few and short trails, and this difference in habit is considered responsible for the failure.

Milne (F. N. J.). **The Effect of Benzene Hexachloride in Poultry Feed on Meat and Egg Quality.**—*Qd J. agric. Sci.* **10** no. 4 pp. 214–221, 5 refs. Brisbane, 1953.

BHC has given excellent protection against insect infestation in seed maize and sorghum in Queensland, and since its use is likely to be extended to grain stored for stock-feeding, its effect on the quality of the flesh of fowls fed on treated grain and on the eggs laid by them was investigated. The following is virtually the author's summary of the work. A commercial BHC dust (12·5 per cent. γ isomer) and a deodorised BHC (99 per cent. γ isomer) were each fed in an all-mash ration at levels equivalent to 5 and 25 parts per million of the γ isomer. Groups of 20 cockerels were fed with treated mashes from 12 weeks of age. The flesh was found to be tainted within five weeks in the group fed with commercial BHC at 25 p.p.m. γ isomer and within seven weeks in the group fed with 5 p.p.m. No taint was found in groups fed with deodorised BHC after 16 weeks' continuous feeding, when the experiment was ended. Groups of 20 pullets were fed with treated mashes from six months of age. Taint was detected in the eggs of those fed with commercial BHC after four weeks of feeding at the 25 p.p.m. level and after six weeks at the 5 p.p.m. level. In the two groups fed with deodorised BHC, at 25 and 5 p.p.m., the eggs were tainted 16 and 18 weeks, respectively, after the beginning of feeding. It is concluded that neither commercial nor deodorised BHC should be used on grain destined for poultry feeding.

Miller (L. W.). **Effects of certain new Fungicides on the European Red Mite in Tasmanian Apple Orchards.**—*Tasm. J. Agric.* **24** no. 3 pp. 209–212, 1 graph, 1 ref. Hobart, 1953.

During 1952–53, TMTD (tetramethyl thiuram disulphide) was widely substituted for sulphur in sprays against black spot (*Venturia inaequalis*) on apple in Tasmania, and the effect of fungicides on populations of *Paratetranychus pilosus* (C. & F.) was accordingly investigated. The experimental trees were sprayed with a home-made sump-oil emulsion while dormant and with bordeaux mixture at the green-tip stage, and subsequently received one of five fungicidal schedules. These comprised the normal programme of two applications of lime-sulphur at the pink-bud and calyx stages followed by three cover sprays of colloidal sulphur at 3 lb. per 100 gals., five applications of a preparation containing 80 per cent. TMTD at 1½ lb. per 100 gals. or one containing 50 per cent. SR406 (N-(trichloromethylthio)-tetrahydrophthalimide) at 2½ lb. per 100 gals., or one application of lime-sulphur followed by two of TMTD or SR406 and two of colloidal sulphur. Lead arsenate was included in the calyx and first two cover sprays and DDT in the third cover spray. A month after the last application, there were significantly fewer eggs and mites per 100 leaves on the plot that received sulphur alone or after TMTD than on the unsprayed trees, not significantly fewer on those that received sulphur after SR406 or TMTD alone, and significantly more on the trees sprayed with SR406 alone than on any others.

The severity of the damage caused by the mite depends not only on the size of the population but also on the earliness at which it becomes large enough to injure the foliage. On trees sprayed with sulphur, such populations do not as a rule develop before January–February, but during 1952–53, numbers were already great by the end of November where TMTD was used and became extremely high after warm, dry weather in late January. Work on the effectiveness of parathion sprays applied to the foliage against *P. pilosus* showed that the best results were obtained when treatment was begun during late December or early January, before foliage injury became apparent. If fungicides of no value against the mite were substituted for sulphur, applications of parathion would have to be begun as early as the first or second cover spray, and in addition there might be an increase in population of *Bryobia praetiosa* Koch, which is not normally abundant in Tasmania and is very susceptible to sulphur.

Yeomans (A. H.) & Van Leeuwen (E. R.). **Insecticide Spray Deposits.**—*Soap & sanit. Chem.* **30** no. 4 pp. 141–143, 3 graphs, 1 ref. New York, N.Y., 1954.

When an atomised spray issues from the nozzle of the sprayer, the droplets move in a stream of air. As this approaches a wall, it is deflected and the smallest droplets are deflected with it. Most of the larger ones are deposited on the wall if the nozzle is held at the correct distance from it, but fall to the floor if the nozzle is too far away, or spatter from the wall if the nozzle is too close. The factors that affect deposition are not clearly understood, and nozzles must therefore be tested individually. In a technique described, particle-size is determined by collecting a spray sample on a slide and measuring by means of a calibrated eyepiece in a microscope, and the proportion deposited is ascertained by comparing the amount applied with the actual amount deposited on a specially designed vertical metal plate, from which the spray is recovered either as natural run-off if the plate is already wet or by means of a squeegee. The nozzles are tested

in a stationary position at various distances from the plate and in an atmosphere saturated with the spray, to prevent loss by evaporation. Typical results obtained with three nozzles of different output are given.

KOBEL (F.). **Jahresbericht 1949–1951 der Eidg. Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil. 2. Sektion Pflanzenschutz.** [Annual Report for 1949–51 of the Federal Experiment Station for Fruit-growing, Viticulture and Horticulture in Wädenswil. Section 2. Plant Protection.]—*Landw. Jb. Schweiz* **66** pt. 6 pp. 592–621, 4 figs., refs. Berne, 1952.

The section on plant protection contains brief accounts (pp. 601–612) of entomological investigations in Switzerland in 1949–51, some of which have already been noticed [*R.A.E.*, A **41** 325, 326]. It was concluded from observations on the flight of *Melolontha melolontha* (L.) (*vulgaris* F.) that the newly emerged adults fly towards the horizon offering the highest silhouette [*cf.* **42** 354], and from a comparison of BHC and DDT for treating woodland against the beetles, that BHC is the more effective, though its duration of toxicity is less.

DDT sprays can be effectively used against the newly emerged adults of *Rhagoletis cerasi* (L.) on cherry provided that they are applied over sufficiently large areas. The trees should be treated as late as possible before oviposition to obtain the maximum period of protection, and regular observations on the time of emergence of the adults from the soil were begun. Batches of 25 puparia were set out in containers on the south side of trees in various districts and examined each day from mid-May to June. The results showed that emergence began 2–3 weeks earlier in a warm than in a cool damp spring and on sunny slopes than in shaded positions, 8–10 days sooner when the ground was only sparsely covered than when it bore thick grass, and a week sooner when the grass was cut early than when it was left standing. The best control is obtained when the grass is left long and cut just before the spray is to be applied, so that the increased soil warmth accelerates emergence of the remaining flies. Experiments on the substitution of parathion for DDT against *R. cerasi* were begun [**42** 69]. Development of the eggs and larvae usually lasts about a month, but is much delayed when the eggs are deposited in green hard fruits and completed in a fortnight when they are laid in nearly ripe ones.

Thomasiniana theobaldi Barnes, which had hitherto been unknown in Switzerland, was found to be widely distributed in the centre of the country on raspberry, and the injury caused by this Cecidomyiid is described [*cf.* **41** 38, etc.]. Parathion proved incompletely effective against the mining larvae, but spraying or watering the soil round the plants with BHC or chlordane shortly before the adults emerged gave good control.

A study of common scale insects on fruit trees was begun, and observations on the morphology and biology of *Quadraspidiotus pyri* (Licht.) revealed that two species have been confused under this name, *Q. pyri* and a form that was to be described by F. Bachmann as *Q. schneideri*, sp. n. [*cf.* next abstract]. The morphological differences between these two species are not great. *Q. schneideri* is the more southerly of the two, and it overwinters as a fertilised female, whereas *Q. pyri* does so as a second-stage nymph. Resistance to winter sprays varied with the overwintering stage, and their effectiveness depended considerably on temperature. Parasitism not infrequently amounted to almost 100 per cent. in *Q. pyri* but was slight in *Q. schneideri*, which is therefore economically the more important.

Bachmann (F.). *Quadraspidiotus schneideri* **n. sp. (Homopt. Diaspidoid.), eine neue Schildlausart.** [*Q. schneideri*, a new Species of Scale Insect.] —*Mitt. schweiz. ent. Ges.* **25** pt. 4 p. 357. Berne, 1952.

A description is given of the adult female of *Quadraspidiotus schneideri*, sp. n., together with characters differentiating it from the closely related *Q. pyri* (Licht.) [*cf.* preceding abstract]. It occurs in the warmer parts of Switzerland, is recorded from apple, pear, plum and *Prunus spinosa*, and is stated to be fairly common on fruit trees.

Zahradník (J.). **Eine neue Schildlausart**—*Quadraspidiotus mařani* **n. sp. (Coccoidea: Diaspididae).** [A new Species of Scale Insect—*Q. mařani*, sp. n.]—*Beitr. Ent.* **2** no. 4–5 pp. 449–451, 1 fig., 4 refs. Berlin, 1952.

Dušková (F.). **Vergleich der morphologischen Hauptmerkmale der Schildläuse** *Quadraspidiotus piri* **(Lichtenstein) und** *Quadraspidiotus mařani* **Zahradník (Coccoidea: Diaspididae).** [Comparison of the chief morphological Characteristics of *Q. piri* and *Q. mařani.*]—*T.c.* pp. 452–455, 2 figs., 9 refs.

It is stated in the first of these papers that observations in Czechoslovakia showed that two species have been confused under the name *Quadraspidiotus pyri* (Licht.), the true *Q. pyri* and one here described from the adult female and the scales of both sexes as *Q. mařani*, sp. n. *Q. mařani* was found principally on fruit trees, but is also recorded from *Crataegus* and *Fraxinus*. First-stage nymphs were observed in the first half of July, and adult females in the first half of September. The latter overwinter, whereas winter is passed by *Q. pyri* as a second-stage nymph.

In the second paper, the author gives characters of the adult females differentiating *Q. pyri* and *Q. mařani*.

Bachmann (F.). **Untersuchungen an den gelben Obstbaumschildläusen** *Quadraspidiotus piri* **Licht. und** *Quadraspidiotus schneideri* **n.sp.** [Investigations on *Q. pyri* and *Q. schneideri.*]—*Z. angew. Ent.* **34** pt. 3 pp. 357–404, 17 figs., 76 refs. Berlin, 1953.

The author describes characters of the pygidium of the second-stage nymphs and adult females differentiating *Quadraspidiotus pyri* (Licht.) and *Q. schneideri* Bachmann [*cf.* last abstract but one], repeats his description of the female of the latter, and states that *Q. mařani* Zahradník, which was described from Czechoslovakia [*cf.* preceding abstract], is a synonym of it. The distribution of the two species in Switzerland is illustrated on a map; investigations showed that *Q. schneideri* was commonest in the south-west, though it also occurred in sheltered localities to the north, and *Q. pyri* in the north and east and the Ticino. *Q. schneideri* was observed by the author to the south of Bolzano, northern Italy, specimens of *Q. schneideri* and *Q. pyri* were received from Lower Austria and Belgium, respectively, and it is concluded from published records of overwintering stages that both species are present in France and Germany, *Q. pyri* also in Hungary, and *Q. schneideri* in Bulgaria. The latter is thus the more southerly of the two.

Both species attack apple, pear and plum and *Q. pyri* also peach, infesting the branches, the trunks if the bark is thin, occasionally the leaf-stalks, and the fruits of apple and pear, and inflict damage that sometimes leads in combination with other factors to the death of the tree. Other

food-plants are shown in a list based on the literature and the author's observations. Since *Q. schneideri* is almost entirely restricted to fruit trees, it is thought to have been introduced with nursery stock from the south, whereas *Q. pyri* is indigenous in Switzerland.

Hatching of the eggs of *Q. pyri* began in June and continued until October, though most of the reproductive females were dead by August. The first nymphal stage lasted at least 47–50 days, the first moult usually occurring in the first half of August. By October, about 95 per cent. of the nymphs were nearing the end of the second stage, and overwintering then occurred. The second moult took place from the second half of March onwards, depending on temperature, and was commonest in April. In a laboratory experiment with infested twigs in water, overwintered nymphs developed most quickly at 20–24°C. [68–75·2°F.], moulting after 15 days. Pairing occurred soon after the moult, and the first eggs were laid in June.

Under equal conditions, hatching of *Q. schneideri* began in late May or early June, about a fortnight before that of *Q. pyri*, and the first moult occurred after 55–60 days. The second stage averaged 30 days, and adult males and females were present and pairing took place at the beginning of September. The females continued to grow in size, but there was no egg development until the following spring, oviposition by the overwintered females beginning at the end of May.

The processes of moulting, scale formation and pairing, which were similar for the two species, are described. Only about half the males were capable of pairing, and many of these paired twice. They survived for scarcely more than an hour. Unfertilised females of *Q. pyri* deposited a normal number of viable eggs, but the sex of their progeny was not known. Under normal conditions, the oviposition periods of the two species lasted not more than two months, and most of the eggs were deposited during the first half. The rate of deposition varied considerably with climate, but was 2–4 eggs per day at the optimum temperature of 20–25°C. [77°F.]. The average and maximum numbers of eggs per female on apple, calculated from counts of empty shells, were 60 and 82 for *Q. pyri* and 66 and 85 for *Q. schneideri*; the differences between the species were not significant. In investigations on the potential rates of increase, apple grafting stock was artificially infested with crawlers and their progeny counted after two years under field conditions, natural enemies being excluded. The average number of females per generation increased tenfold for *Q. pyri* and eightfold for *Q. schneideri*, the females constituting 44 and 47 per cent. of the population, respectively. This test was carried out in a climate unfavourable to *Q. schneideri*, and the effect of climate on reproduction was shown in another test with *Q. pyri* in a milder locality, in which the plant was transferred in autumn to an insectary where conditions were comparable with those of an unheated glasshouse. The females produced an average of 71 progeny each, 58 per cent. being females.

In studies on the influence of temperature on natural mortality, potato tubers were infested with crawlers of *Q. pyri* and kept at different constant temperatures for up to a month. Mortality was very high below 17°C. [62·6°F.] and above 32°C. [89·6°F.] and least at about 24°C. On apple in the field, the percentage mortality was 57 and 15 by 20th September for first- and second-stage nymphs of *Q. pyri*, respectively, 15·2 for second-stage nymphs during the winter of 1948–49, and 8·8 for females of *Q. schneideri* in the winter of 1947–48. It is concluded that temperature is a limiting factor only in summer.

The part played by the crawlers in the spread of infestation can only be small, especially among non-contiguous trees, though some may be carried by wind [*cf. R.A.E.*, A **5** 16], and distribution is effected chiefly with

nursery stock. The establishment of colonies depends on the availability of suitable food-plants, and in laboratory experiments, crawlers of both species were successfully transferred from apple to apple and those of *Q. schneideri* from plum to plum, but apple was infested only with difficulty by *Q. schneideri* from pear or by *Q. pyri* from ash, and not at all by *Q. schneideri* from plum. Affinity for the food-plant also affected the rate of reproduction.

The possibility that differences in the overwintering stage resulted from the differing climatic preferences of the two species was investigated by rearing each in a locality with a climate preferred by the other, though with negative results, and attempts were made artificially to obtain fertilised females of *Q. pyri* in autumn, but second-stage larvae removed to the laboratory at the beginning of October died after 6–9 months at 20°C. without developing further. Overwintering females of *Q. schneideri* also failed to continue development at favourable temperatures without prior exposure to cold. The overwintering stages were therefore specific and fixed by a diapause, and there is thus no possibility of two generations developing within a year. Almost all the nymphs of *Q. pyri* that were removed to the laboratory on 24th October moulted after 50 days at 20°C., whereas almost all those removed at the end of December did so after the normal interval of 15 days. Measurement of females of *Q. schneideri* showed that they too grew slightly in December–February in the field.

Both species were parasitised by *Aphytis mytilaspidis* (LeB.), and *Q. pyri* also by *Aspidiotiphagus citrinus* (Craw) and *Pteroptrix dimidiatus* Westw., and both were attacked by the Coccinellids, *Chilocorus bipustulatus* (L.) and *C. renipustulatus* (Scriba). The fungus, *Fusarium larvarum*, caused complete mortality of single colonies of *Q. schneideri* in one area. Parasitism of *Q. pyri* normally amounted to 50–95 per cent., which kept infestation below the level at which chemical control is necessary, but that of *Q. schneideri* rarely exceeded 10 per cent.

In a small-scale preliminary test on control, sprays of 4–6 per cent. tar distillate and 3 per cent. white oil applied in late January 1948 proved unsatisfactory against *Q. pyri*, and *Q. schneideri* was even more resistant. The toxic action of oils on Coccids is discussed, and it is shown that death does not result from asphyxiation following the formation of an air-tight layer over the scales, mortality on twigs hermetically sealed by immersion in paraffin not rising appreciably until after 72 hours at 20°C., whereas treatment with 5 per cent. oil or oil and DNC caused high mortality in 24 hours. In field tests in February–March 1949, satisfactory control was given by proprietary sprays of oil with or without the addition of DNC, 3 per cent. of products containing about 80–90 per cent. oil and 5 per cent. DNC being equal in effectiveness against *Q. pyri* to 4 per cent. of one containing about 80 per cent. oil alone, and 3 per cent. of the latter as effective against *Q. pyri* as 4 per cent. against *Q. schneideri*. At 4 per cent., the oil emulsion gave complete control of *Q. schneideri* when applied at a temperature below freezing-point [*cf.* **40** 132, etc.]. The tests against *Q. schneideri* were continued in 1949–50 with sprays applied on different dates between December and March. Toxicity was slight at first when temperatures were low and the insects were still in diapause, but increased as the season advanced, mortality averaging 96–99 per cent. for products of the two types at 4 per cent. applied on 22nd March. The importance of insolation, particularly late in the winter, was shown in one instance in which the control percentages were 75 on the south side of a tree sprayed in February and 45 on the north side.

Summer treatments tested against the nymphs of *Q. pyri* comprised oil emulsions with or without DDT, and products containing derris, parathion and DDT with parathion. All proved unsatisfactory.

[illegible] (W.). **Die Phänologie der Kontaktintoxikationen im** *Drosophila*-**Test.** [The Phenology of Contact Intoxication in the *Drosophila* Test.]—*Z. angew. Ent.* **34** pt. 3 pp. 386–398, 20 refs. Berlin, 1953.

A knowledge of the symptoms caused by a contact insecticide is often useful for qualitative analyses and also for assessing the results of tests before the occurrence of death. The author therefore describes and compares the reactions of the test insect, *Drosophila melanogaster* Mg., to contact with deposits of DDT, BHC, parathion or methyl-parathion, and toxaphene (E 3956). Four stages in the progress of intoxication are distinguished, the first being the period before the occurrence of any visible effect, the second that of excitation, the third that of exhaustion, when the insects lie on their backs, and the fourth that between the onset of immobility and death. The behaviour of untreated flies is also described for comparison.

Riemschneider (R.). **Literatur zur HCH- und Dien-Gruppe. Liste V.** [Literature on the BHC and Diene Group. List V.]—*Z. angew. Ent.* **34** pt. 3 pp. 405–460. Berlin, 1953.

This supplement to a list already noticed [*R.A.E.*, A **40** 372] contains the titles of about 1,500 works on insecticides of the BHC and diene groups published up to 1st December 1951.

[illegible] (F.). **Zur Überwinterung und Generationenzahl von** *Xyloterus signatus* **Fbr. (Coleopt., Scolytid.).** [On Hibernation and the Number of Generations of *X. signatus*.]—*Z. angew. Ent.* **34** pt. 3 pp. 461–462, 4 refs. Berlin, 1953.

In view of the statement that *Xyloterus signatus* (F.), a pest of coniferous timbers, overwinters in the adult stage in ground litter [*R.A.E.*, A **21** 660], the author records the finding of adults of this Scolytid at the end of August 1952 beneath bark scales of oak in south-western Germany. The beetles occurred singly, and most of them were found in trees at points where the bark had previously been heavily attacked by an unidentified Anobiid. None was found in the ground litter. The beetles were still present in mid-October and were obviously overwintering. As they are known to emerge in July, it is assumed that they at once seek hibernation sites and do not reproduce until the following year.

Nolte (H. W.) & Fritzsche (R.). **Untersuchungen über das Vorkommen verschiedener** *Meligethes*-**Arten auf Raps.** [Investigations on the Occurrence of various Species of *Meligethes* on Rape.]—*Beitr. Ent.* **2** no. 4–5 pp. 434–448, 7 figs., 12 refs. Berlin, 1952.

Lists are given of seven species of *Meligethes* recorded from rape in Bavaria and of four of these and three others found as adults on the crop in other parts of Germany in 1951. The adults of all ten are briefly described, and their distribution is shown on a map. *M. aeneus* (F.) and *M. viridescens* (F.) occurred in all areas, and *M. coracinus* Sturm was also widely distributed. These were the only species of importance in 1951, the others occurring only locally and in small numbers. The relative frequency of the species found in that year in April, May and June is shown in tables. *M. aeneus* became less common and *M. viridescens* and *M. coracinus* more

so during the period of full bloom, *M. viridescens* greatly predominating in Mecklenburg. There were considerable local differences in the composition of the population at a given time, and the importance in this respect of differences in climate and soil conditions is discussed.

Schneider (F.). **Untersuchungen über die optische Orientierung der Maikäfer** (*Melolontha vulgaris* **F. und** *M. hippocastani* **F.) sowie über die Entstehung von Schwärmbahnen und Befallskonzentrationen.** [Investigations on the optical Orientation of Cockchafers (*M. melolontha* and *M. hippocastani*), and on the Occurrence of Lines of Flight and the Intensity of Infestation.]—*Mitt. schweiz. ent. Ges.* **25** pt. 4 pp. 269–340, 2 fldg. pls., 23 figs., 39 refs. Berne, 1952.

A detailed account is given of investigations in several parts of Switzerland in 1951–52 on the flight of *Melolontha melolontha* (L.) (*vulgaris* F.) and *M. hippocastani* F., particularly that of the newly emerged adults to woodland for maturation feeding. Observations on the direction and intensity of flight were made in the field at the normal time of emergence, and also by collecting the beetles from the soil in April, keeping them in boxes of soil at 2°C. [35·6°F.] and releasing them from selected sites in early summer. Observation of these was facilitated by attaching small tissue-paper streamers to them. The emerging adults became immobilised immediately on entering daylight, but were re-activated at dusk, and the processes of immobilisation and re-activation were both reversible. The beetles first described a spiral flight above the emergence site, and during this the entire horizon was optically examined and a certain section selected as the primary flight goal.

M. melolontha usually flew towards the section of the horizon offering, within its sight range of about two miles, the silhouette of maximum average height over an arc of 50–90°, unless its outline was obscured by cloud [*cf. R.A.E.*, A **41** 328], but a near silhouette was as attractive as a distant one of double the apparent height on the opposite horizon. When bad weather delayed emergence for several days, a positive phototropism developed and the beetles then showed a marked preference for silhouettes against the brighter west or north-west horizon. The line of flight towards a high silhouette was not direct, since the beetles flew close to the ground. If the primary flight goal proved unsuitable for feeding, a second was selected in renewed spiral flight. All the beetles emerging in one area were subject to the same influences and flew towards the same section of the horizon. Flight was most intense when beetles from a large area, attracted to a site unsuitable for feeding, set out in secondary migration. Flight behaviour was particularly studied in localities in which two or more sections of the horizon were equally attractive, and the results are recorded in detail. It was possible to forecast the sites of feeding for many areas without difficulty, and the use of such forecasts for chemical control [*cf.* **40** 188] is discussed. The subsequent flight in search of oviposition sites is described, and three phases are distinguished. Males and some females not yet ready to oviposit took part. The return to woodland for further feeding was governed by the same conditions as the primary migration, so that the beetles were not necessarily attracted to the original feeding sites.

In the absence of a high silhouette, *M. melolontha* flew to neighbouring single or grouped trees. *M. hippocastani* behaved in the reverse way, preferring trees or similar objects in the immediate vicinity, but flying in their absence towards the highest silhouette, unless this stood out against a very bright sky.

Martin (Henri). **Contribution à l'étude de la mouche de l'olive** *Dacus oleae* **Rossi (Dipt. Trypetid.) en Algérie et en Provence.**—*Mitt. schweiz. ent. Ges.* **25** pt. 4 pp. 341–348, 5 figs., 1 ref. Berne, 1952.

The author's observations on the bionomics and control of *Dacus oleae* (Gmel.) on olive, begun in Spain in 1946–48 [*R.A.E.*, A **39** 418], were continued near Algiers in 1949–51 and in the south of France in 1951–52.

In Algeria, trap-glasses baited with 4–5 per cent. crude ammonium phosphate were hung in the trees and examined weekly from 9th May 1949 to the end of January 1951. Flight was practically uninterrupted during that period, but reached its main peak in both years in June–July, when the first mature females were appearing, and remained considerable though sporadic until the following January. In general, more adults were caught in 1949 than in 1950. Puparia collected beneath the trees in December–January and placed in pots in the insectary gave rise to adults from 10th February until the end of March, with a maximum at the beginning of March. Males generally predominated at the beginning and females towards the end of each flight period.

In a test of vertical distribution, a mast was set up at the foot of a tree and five pairs of traps hung from horizontal bars at intervals of slightly over six feet, the first pair being level with the lowest branches of the tree, the second and third with the crown, the fourth with the topmost branches, and the fifth being six feet above the top of the tree. In all, 1,000 adults were taken between April and November 1950, the majority in the second and third pairs, more in the fourth than in the first, and none in the fifth. The sex ratio also varied, the percentage of females being about 40 at the base of the crown, 45–50 at its centre and 18 at the top.

Traps were also hung in comparative tests on carob [*Ceratonia siliqua*] and various fruit trees, and a list is given showing the numbers of flies per trap taken between 20th April and 20th July. These were much the highest on olive, considerable on carob and guava, and low on persimmon, stone fruits, *Citrus*, vines, pear and loquat. The numbers taken on carob reached peaks at the same times as on olive, but females predominated at first on carob and males later. It thus appeared that females needed to feed on plants other than olive before reaching sexual maturity. On olive, the first eggs were observed in 1949 on 26th June, and the first summer generation developed in about 35 days. The subsequent generations overlapped, and there were probably 3–4 altogether in the coastal region. Although infestation began early, the percentage of fruits infested remained low until late in the season, rising to 66 in November and averaging 60 at harvest in December. Wild olives were unimportant as a source of infestation.

In a control experiment, sprays of 0·25 per cent. DDT were applied six times at intervals of about a fortnight from the time oviposition began, but infestation continued, though on a reduced scale, and 30 per cent. of the fruits were infested at harvest, as compared with 60 for no treatment. The failure of DDT is attributed to the temperature, which rarely fell below 30°C. [86°F.] during the day, whereas in Spain, where similar treatment proved effective [*cf. loc. cit.*] against a heavier but later infestation, the temperature never exceeded that figure. *Ceratitis capitata* (Wied.) has also been shown to be highly resistant to DDT at temperatures above about 30°C.

Similar traps baited with 3–4 per cent. diammonium phosphate were used on olive in Provence from June 1951 to June 1952. In one area, only two immature females and one male were taken throughout the 1951 season and the olives were not infested, but in another, flight began early in July

1951 and lasted almost continuously until the end of November, reaching maxima in late September and mid-November. In 1952, flight began in the last week of June, and many more examples were taken than in the previous year, though all the females were immature. The sex ratio was very variable, but females markedly predominated during periods of maximum flight. Mature females were taken at the end of July and the beginning of August, from September to mid-October, and at the end of November, and they predominated from mid-September to the beginning of October. The proportions in which eggs, larvae and pupae were present in the olives in September–November are shown on a graph. Infestation reached 80–86 per cent. in October, but was only 60 per cent. at harvest, since some infested fruits were shed. Complete development lasted 35–40 days in August–September, and there were three generations in 1951, the last being probably only partial.

DI MARTINO (E.). **L'*Aceria sheldoni* Ewing nuovo parassita degli agrumi in Sicilia e Campania.** [*A. sheldoni*, a new Pest of *Citrus* in Sicily and Campania.]—*Boll. Lab. Ent. agr. Portici* **12** pp. 1–15, 5 figs., 11 refs. Portici, 1953. (With a Summary in English.)

The Eriophyid that causes malformation on *Citrus* in Sicily [*cf. R.A.E.*, A **41** 244] was identified by H. H. Keifer as *Aceria sheldoni* (Ewing), and since it seemed likely that it also occurred on the mainland of Italy, investigations were made near Portici in 1951. These resulted in the finding of the mite on lemon, but the damage caused was slight. All stages of *A. sheldoni* are described, and its distribution is reviewed. In Sicily, it severely attacks lemon and also bitter orange grown for stocks in nurseries, but damage to sweet oranges was not serious. The eggs were laid singly or in groups of up to five, usually in the new buds, and the life-cycle from oviposition to adult emergence lasted about 15 days, depending on the time of year.

In experiments on control, two light mineral oils were applied to lemon trees at 1·75 per cent. at the end of July, when the temperature was high, and examination of the new shoots on 20th September showed that the percentages that were normal, slightly injured and seriously deformed were about 50, 29 and 22 on the treated trees and nearly 19, 26·5 and 55 on the untreated ones. There was no difference in the efficiency of the two oils, and no scorching was observed on the sprayed trees.

PARKER (H. L.). **Miscellaneous Notes on South American Dipterous Parasites.**—*Boll. Lab. Ent. agr. Portici* **12** pp. 45–73, 103 figs., 8 refs. Portici, 1953.

The author gives a classified list of Diptera found in association with various hosts in South America during studies on the biological control of *Diatraea saccharalis* (F.), *Pseudaletia* (*Cirphis*) *unipuncta* (Haw.) and other insects, with locality records and notes on the bionomics of some of them. Those identified to species include *Paratheresia claripalpis* (Wulp) (*diatraeae* (Brèth.)), *Metagonistylum minense* Tns., *Parthenoleskia parkeri* Tns., *Zenillia* (*Palpozenillia*) *diatraeae* (Tns.) and *Sarcophaga* (*Sarcodexia*) *lambens* Wied., which parasitise *D. saccharalis* in Brazil, and the last also in Uruguay; *Nepophasmophaga facialis* Tns. and *Parkerella parva* Tns., which the author believes to be parasites not of *D. saccharalis* as suggested by Townsend [*cf. R.A.E.*, A **30** 425; **31** 120] but of the earwig, *Doru lineare* Esch., in Brazil; *S. lambens*, *Phorocera* (*Patelloapsis*) *rusti* Aldr. and *Zenillia tucumanensis* Sellers, which were reared from *Alabama argillacea* (Hb.) in Argentina; *Actinoplagia koehleri* Blanch. from *Heliothis armigera*

(Hb.) in Uruguay; *Peleteria robusta* (Wied.) from *Pseudaletia unipuncta* in Uruguay; *Voria ruralis* (Fall.), which parasitises *Rachiplusia nu* (Gn.) in Uruguay and Argentina; *Xenopyxis edessae* Tns., which was reared from adults of *Edessa meditabunda* (F.) and *E. rufomarginata* (Deg.) in Uruguay; *Incamyia chilensis* Aldr. from larvae of *Laphygma frugiperda* (S. & A.) in Uruguay; and *Phorocera rusti* reared from *Anticarsia gemmatalis* Hb. in Paraguay and *R. nu* in Uruguay.

Roberti (D.). **Contributo alla conoscenza delle specie italiane di** *Mayetiola* **Kieffer (Diptera—Cecidomyiidae).** [A Contribution to Knowledge of the Italian Species of *Mayetiola*.]—*Boll. Lab. Ent. agr. Portici* **12** pp. 98–153, 31 figs., 14 refs. Portici, 1953. (With a Summary in English.)

The species of *Mayetiola* recorded from Italy by the author are *M. mimeuri* (Mesnil), *M. destructor* (Say), *M. avenae* (Marchal) and *M. bromicola*, sp.n. Descriptions are given of the genus *Mayetiola*, of the larvae, puparia and adults of both sexes of all four species and of the eggs and pupae of *M. mimeuri*, together with a key to them based on the characters of various stages and the plants attacked.

M. mimeuri, which had so far been recorded only from Morocco and Algeria [*R.A.E.*, A **23** 145], was taken causing great damage to barley north of Naples in 1947 and did not attack neighbouring wheat. Adult emergence began towards the end of March and reached its peak in mid-April. The females laid their eggs singly or in rows of 3–4 on the upper surfaces of the leaves, and dissected females contained 200–600 eggs each. The newly hatched larvae migrated downwards between the stem and the sheath, reaching the bases of young plants and lodging in the joints of older ones. Swellings appeared at the sites of infestation. During the severe attack of 1947, up to 30–40 puparia were found per plant, but the numbers were usually much lower. Heavy infestation in autumn killed the plants, but a light attack retarded development and resulted in the formation of new shoots, though the ears were reduced in size if the larvae attacked the second or third joint. Varieties sown in October were severely injured, and those sown in November slightly less so.

M. destructor caused severe damage to wheat near Naples in 1951, but did not attack barley growing next to the infested fields. *M. avenae*, which is restricted to oats, has been recorded causing damage in Apulia [*cf.* **18** 43] and also occurs further to the north. *M. bromicola* was observed on *Bromus sterilis* at Portici, and the galls that it causes on this grass were observed there by Cristinzio in 1933; his description of them is quoted. Self-sown oats and barley were not infested. Adults appeared in spring and autumn, so that there are two generations a year.

Jannone (G.). **Contributi alla conoscenza morfo-biologica e sistematica dell' Ortotterofauna dell' Eritrea. VII. Studio sul comportamento della** *Schistocerca gregaria* **(Forsk.) in Eritrea dal 1939 al 1946 in rapporto di fattori ambientali e comparazioni col comportamento delle infestioni anofeliche.** [Contributions to the morpho-biological and systematic Study of Eritrean Orthoptera. VII. A Study of the Occurrence of *S. gregaria* in Eritrea from 1939 to 1946, in Relation to climatic Factors, and a Comparison with the Occurrence of Anopheline Infestation.]—*Boll. Lab. Ent. agr. Portici* **12** pp. 189–248, 23 figs. Portici, 1953. (With a Summary in English.)

The observations on *Schistocerca gregaria* (Forsk.) recorded in this part of a series [*cf. R.A.E.*, A **41** 396] were made in Eritrea in 1939–46. It is

stated in the first section that *S. gregaria* phase *solitaria* occurs permanently in the eastern lowlands, and though solitary individuals are occasionally blown by winds on to the eastern slopes, they do not become established there. This phase does not cause damage of economic importance. Transformation to phase *gregaria* occurs in favourable localities and is related to the presence of *Heliotropium undulatum* and bulrush millet (*Pennisetum typhoides*). A list is given of 42 localities in which this is likely to take place, and it is considered that although treatment of these areas would not eliminate all swarms, since some enter the country from neighbouring territories, it would be of assistance. There are usually two generations of the solitary phase during the rainy season from December to May, though only one may develop if the rainfall is slight. During the last 60–70 years, much of the water that flows down towards the Red Sea from the highlands in July–October has been canalised and used for irrigation in grain fields, so that breeding now continues in the lowlands after the rains, at least one further generation being produced.

The second section deals with phase *gregaria* and opens with a review, based on the author's observations, of the main trends in swarm movements in Eritrea during years of locust activity and the damage caused to local crops. The most injurious are the swarms that arrive in September–October from northern Ethiopia and the Sudan. They join with those that develop within the country and move eastwards at a time when food grains are maturing, and also attack fruit trees and other crops. Some of the swarms that invade Eritrea are not sexually mature and do not oviposit for 15–40 days, depending on the climate and the food-plants available; the period may occasionally be as long as two months if the swarms circulate over arid regions. The females oviposit 2–4 times during their life of 100–120 days, laying their eggs in sandy soil with a fair degree of humidity. The eggs normally hatch in 10–16 days, only rarely requiring more than 20 days, and are sensitive to dryness. The duration of the hopper stage varies from 35–36 days in the hottest zones to 44–45 days in the coolest and most humid areas. Hoppers that hatch on the eastern slopes in December–January are an exception, their development being retarded by excessive humidity, heavy mists and lack of sun. The section concludes with a review of the wild and cultivated plants that are attacked.

In the third section, the author discusses the relation between the locust and uncultivated land in Eritrea. Both phase *solitaria* and phase *gregaria* oviposit in cultivated and uncultivated soil, so that the extension of cultivation has not by itself favoured egg-laying. On the other hand, it has favoured the formation of outbreak centres in which transformation to phase *gregaria* occurs, by providing preferred food-plants, especially *Pennisetum typhoides*, which has been increasingly grown in the last 40–50 years. It is concluded that actual or potential damage by species of locusts that oviposit in hard, uncultivated soil is in direct ratio to the proportion of uncultivated land, but that for those that oviposit in soft soil, whether cultivated or not, it is in inverse ratio to the proportion of uncultivated land. Cultivation might be thought to favour the development of locusts of the second type, but in Eritrea, the areas of uncultivated soil suitable for oviposition are so great that cultivation makes little difference.

The author further discusses the degree to which the breeding seasons of *S. gregaria* and Anopheline mosquitos that transmit malaria coincide in Eritrea and compares conditions there with those in southern Italy, where various locusts and grasshoppers are sometimes injurious. The coincidence of breeding seasons is much less in Eritrea, and the risk of exposure of locust-control workers to malaria infection is relatively small. The social consequences of locust infestation and malaria are compared and contrasted.

Russo (G.) & Santoro (R.). **Esperimenti di lotta antidacica eseguiti in Ascea Marina (Salerno) nel 1952.** [Experiments in Ascea Marina (Salerno) in 1952 on the Control of *Dacus oleae*.]—*Boll. Lab. Ent. agr. Portici* **12** pp. 249–331, 11 figs., 1 fldg. table, 2 refs. Portici, 1953. (With a Summary in English.)

An account is given of further experiments on the control of *Dacus oleae* (Gmel.) on olive carried out near Salerno [*cf. R.A.E.*, A **41** 392–393] in 1952 with chlorinated hydrocarbons, parathion, bait-sprays, repellent sprays and a systemic insecticide.

Infestation of the fruits began early in July but did not become severe until September and October. Sprays of the 50 per cent. DDT paste tested in the previous year [*loc. cit.*] and an emulsion concentrate containing 50 per cent. technical DDT were applied in late July, early August (following rain), late September (delayed by rain), the third week of October, and early November, and another 50 per cent. DDT paste, prepared so as to be mixed cold, was applied on the last four occasions. The November applications proved to have been unnecessary as the deposits from the previous ones still retained their effectiveness and the *Dacus* population fell considerably owing to a drop in temperature at the beginning of the month. Counts of damaged and undamaged olives were made five times between 18th August and 14th November, and the first of these materials at 3 per cent. in sprays prepared with and without heat gave 83·5–88 and 69·3 per cent. uninjured fruits, respectively, on the first of these dates and 84·3–88·5 and 61·1 per cent. on the last, by which time almost all the olives on untreated trees had been damaged; it was somewhat less effective at 2 per cent., the sprays prepared with heat again proving superior. The second material at 3 per cent. gave 88·4–98·1 per cent. uninjured fruits on the first date and 87·9–93·6 per cent. on the last, when only 0·87–27·3 per cent. of the olives on untreated trees were undamaged, and was rather less effective at 2 per cent. The third at 3 per cent. gave 100 per cent. uninjured olives at the first count and 86·7 per cent. at the last, when less than 1 per cent. were uninjured on the controls. It was much less effective at 2 per cent. A product containing 25 per cent. each of technical DDT and γ BHC remaining from the previous year was applied to a small number of trees at 1, 2 and 3 per cent. on about the same five dates. The percentages of undamaged fruits were 82·8, 80·2 and 77·6, respectively, on 18th August and 32·8, 81·5 and 93·8 on 14th November, when less than 1 per cent. were undamaged on the controls.

The increases in the percentage of undamaged fruits observed in some of these tests were due to the classification as undamaged in later counts of olives that had been punctured and earlier counted as damaged but that later seemed free from infestation.

A wettable-powder spray containing 0·09 per cent. parathion and a dust containing 4 per cent. parathion were applied on 7th–8th August, 24th September, 22nd October and 8th November, and counts on 18th August, 13th October and 11th November showed that the percentages of uninjured fruits were 81·7, 74·1 and 67·3, respectively, for the spray and 91·5, 47·6 and 69 for the dust, as compared with 99·5, 35·1 and 2·3 for no treatment. The inferior results are attributed to excessive intervals between the treatments. Many of the infested olives from the sprayed trees contained larvae that had been killed in the early stages of development [*cf.* **41** 393, etc.] and eggs that had failed to hatch. Some of the older larvae near the surface of the fruits were also dead, but full-fed individuals were rarely affected.

Tests were also made with the two bait-sprays used in 1951 [**41** 393], the Berlese mixture of molasses and sodium arsenite and the De Cillis

mixture, which is stated to contain 50 per cent. grape juice, 40 per cent. commercial sucrose, 4 per cent. sodium arsenate, and essential oils, and is diluted to 5 per cent. by weight before use. The sprays were applied five times over large areas between 14th and 19th July, 7th and 12th August, 27th September and 1st October, 14th and 19th October and 3rd and 7th November, but the protection given was quite inadequate against the heavy populations that developed in autumn. When the Berlese mixture was applied on 14th July and 7th August and 2 or 3 per cent. of the DDT emulsion concentrate on 24th September, 22nd October and 7th November, 94·9 per cent. of the fruits were uninjured on 18th August and 73·8 and 86·5 per cent., respectively, on 13th October, and the weaker DDT spray further resulted in 79·7 per cent. sound fruits on 14th November, as compared with 2·33 per cent. for no treatment. In a similar test, the bait-spray was applied on 19th July, 12th August and 1st October, and the DDT concentrate at 3 per cent. on 23rd October and 7th November; protection was much reduced, and it was evident that the DDT treatment had been begun too late. When 0·09 per cent. parathion was substituted for DDT in the same spray programme, 79·5 per cent. of the olives were uninjured on 13th November. It is concluded that such combined treatments are worth further investigation. A repellent spray of clay and a wetting agent gave excellent results until the autumn rains, and again showed the usefulness of treatments of this type for early varieties.

In small scale tests, sprays prepared from a liquid concentrate and a wettable powder to give 0·175 and 0·1 per cent. toxaphene, respectively, were applied on 5th and 21st October and 3rd November, but they gave no control of infestation, and a systemic phosphorus insecticide (Pestox 63) applied four times as a spray between 28th July and 21st October differed little from parathion in effectiveness and also killed young larvae in the olives. There was little evidence of systemic effect.

Graniti (A.). **Ricerche sulle anomalie fogliari dell'olivo in Sardegna. I. Studio delle alterazioni indotte da** *Eriophyes oleae* **Nalepa alle foglie di olivo.** [Investigations on the Deformation of Olive Leaves in Sardinia. I. A Study of the Changes caused by *E. oleae* on Olive Leaves.—*Ann. Sper. agr.* (N.S.) **8** no. 3 pp. 709–715, 8 pls., 7 refs. Rome, 1954. (With a Summary in English.)

A deformation of the leaves of olives recently observed in Sardinia was found to be due to *Eriophyes oleae* Nal., a mite that had not previously been recorded from Italy. Two types of injury were distinguished, malformation of the blade on newly opened leaves and blistering on older ones, and both sometimes occurred on the same leaf.

Boselli (F.). **Risultati della sperimentazione antidacica in Sardegna, nel 1952.** [The Results of Experiments against *Dacus oleae* in Sardinia in 1952.]—*Ann. Sper. agr.* (N.S.) **8** no. 3 pp. 751–771, 1 fldg. pl. Rome, 1954. (With a Summary in English.)

An account is given of experiments in 1952 on the control of *Dacus oleae* (Gmel.) on olive, carried out near Cagliari, Sardinia, in a single block of 5,000 trees, 80 per cent. of which were of a local variety resistant to the summer drought. Infestation does not usually become serious on this variety until the first autumn rains fall in the second half of September, when the development of the fruits is resumed.

Two spray products each containing 50 per cent. DDT were applied at 2 and 3 per cent., the first twice only, after which treatment with it had to be abandoned as the insoluble ingredients prevented the spray apparatus from functioning properly, and the second on 4th–6th and 27th–28th August, 23rd–24th September and 22nd–23rd October. A spray containing 0·09 per cent. actual parathion was applied on 12th–13th August, 2nd and 27th September and 14th October, and one of 2 per cent. dieldrin was applied on 3rd and 29th September and 23rd–25th October. Two arsenical bait-sprays, the Berlese mixture of molasses and sodium arsenite [*cf. R.A.E.*, A **41** 393] and the De Cillis mixture [a mixture of 50 per cent. grape juice, 40 per cent. sucrose, 4 per cent. sodium arsenate, and essential oils, diluted to 5 per cent. (*cf.* **42** 359)], were each applied on 11th–12th August, 1st–3rd and 29th September and 25th October.

The degree of infestation was lower on untreated trees used as controls near those sprayed with the synthetic insecticides than on trees near the areas treated with the bait-sprays, and this is attributed to some measure of protection afforded to the former by the neighbouring treatments. Counts of infested fruits were made seven times between 21st August and 29th November, and the percentages had risen by the last date to 85·1 and 95·8 for the two controls, 6·4 and 2·4 for the second DDT product at 2 and 3 per cent., respectively, 23·3 for parathion, 14·9 for dieldrin, and 65·4 and 94·3 for the Berlese and De Cillis bait-sprays.

Residues of parathion and DDT in the oil pressed from treated olives 60 days after the last application were excessive (5·6 and 60–100 parts per million, respectively).

It is pointed out that the yield from olives in Sardinia is low, owing mainly to bad cultural practices, so that the use of control measures, even of the Berlese spray, which is inexpensive, would not be economic. Practices should be improved and early, eating varieties excluded in favour of the local drought-resistant one which is used for oil only.

HAYWARD (L. A. W.). **The Field Fumigation of Groundnuts in Bulk.**—*J. Sci. Fd Agric.* **5** no. 4 pp. 192–194, 2 graphs, 2 refs. London, 1954.

In 1951, the problem of storing bagged shelled groundnuts at Kano, northern Nigeria, was less acute than in the previous year [*cf. R.A.E.*, A **40** 200] as removal was possible before the beginning of the rains, and some were stored in the open on plinths in oblong or square flat-topped " dumps " containing up to 350 tons. Many of the pyramids and dumps became seriously infested with *Trogoderma granarium* Everts, however, and methods of fumigating them under gas-proof sheets were tested.

In a pyramid of 730 tons, fumigation from the top with 150 lb. methyl bromide, applied in 40 minutes through jets, without a compressor, during the time of the usual early morning breeze, resulted in a high initial concentration of gas in the outer sacks, which fell off rapidly during the first few hours, whereas the concentration in the most remote internal sack near the base gradually rose to a rather low maximum after 4–8 hours and then decreased; the minimum concentration-time product was 81 mg./hours after 22 hours at this point [*cf.* **40** 265–266].

In a flat-topped dump 60 ft. long, 50 ft. wide and 8 ft. high containing 351 tons of groundnuts, channels about 4 ft. wide and 4 ft. deep were made along and across the surface by restacking, and copper gas-delivery pipes with eight atomising jets were laid in these, after which the dump was covered with overlapping rubber sheets tightly rolled together at the joins, and a dosage of 70 lb. methyl bromide was applied in 20 minutes without a compressor. The gas concentrations were found to be much higher and

more uniform than in the pyramid, with little difference between that in the free space and that within an internally sited sack near the bottom layer, and the minimum concentration-time product after 20 hours was 126 mg./hours. No living insects were found after fumigation. No escape of gas could be detected in either case, and much methyl bromide was still present after 2–3 days of airing.

It seems that penetration of the gas into the internal regions of a large stack such as a pyramid is somewhat slow and that much gas disappears in the process, probably owing to diffusion into the very porous base. Although the same loss must occur in dump fumigation, all the sacks receive a satisfactory dose before much loss takes place. The dosage applied (about 1 lb. methyl bromide per 5 tons groundnuts) was possibly about double the minimum effective rate, and investigations are being made to determine whether it can safely be reduced.

El Nahal (A. K. M.). **Fumigation of agricultural Products. VII. Penetration and Sorption of Ethylene Oxide in Wheat fumigated at reduced Pressures.**—*J. Sci. Fd Agric.* **5** no. 4 pp. 205–208, 1 graph, 10 refs. London, 1954.

The author describes tests with ethylene oxide as a fumigant for bagged wheat at dosages of 6–14 mg. per litre, carried out by the same methods as those used in the tests with hydrogen cyanide described in the preceding part of this series [*cf. R.A.E.*, A **42** 232], and compares the results obtained with the two compounds. The fumigant supplied contained an added 10 per cent. carbon dioxide, which might have affected the results [*cf.* **20** 696], and the liquid ethylene oxide was therefore siphoned off before use.

Analyses of variance of the concentration-time products attained and of the residual-fumigant values at the sampling points showed that the relative order of importance of the main factors (moisture content, dosage, method of fumigation and site of sampling) and of their interactions agreed with the values found for HCN. There was, however, a greatly reduced concentration gradient in the wheat, demonstrating the lower sorption of ethylene oxide as compared with HCN, and analyses of the residual fumigant in the wheat confirmed this by showing a much smaller difference between the central and outer sampling positions.

Concentration-time products at the centre of the sack were again small for fumigation at atmospheric pressure and vacuum fumigation with simultaneous admission of air and fumigant and higher for fumigation under sustained vacuum, confirming the greater general effectiveness of the last method. The respective penetration factors [*cf.* **41** 350] were 31, 33·6 and 67·2 per cent. in one series of tests, indicating that ethylene oxide is much less strongly sorbed by wheat than HCN, whichever the method of treatment. During fumigation of wheat samples of 13 and 17 per cent. moisture content, under sustained vacuum, the concentration in the grain reached a higher level than that of the free space; it was higher in the centre of the sack than near the surface and resulted in residues of 53 and 21 parts per million in these situations, respectively. This phenomenon was apparently limited to fumigation of wheat with a moisture content of more than 10 per cent., which suggests that water, either sorbed or as vapour, plays some part in determining the enhancement of the intergranular concentration of fumigant. There is evidence that evaporation of water from the seed-coat during vacuum fumigation may account for some desorption of fumigant from the outside layers of grains towards the perimeter of the sack, but the quantity of fumigant that can be transferred in this way to the centre of the sack seems insufficient to account for the results observed.

Air-washing appeared ineffective in removing fumigant from the free space after fumigation under sustained vacuum, and two air-washes barely compensated for the enhanced concentration in the wheat after the restoration of atmospheric pressure. The rise in intergranular concentration after the second air-washing cycle following vacuum fumigation with simultaneous admission of air and fumigant resembled that in the first cycle after the sustained-vacuum method. The moisture content of the wheat influenced the sorption much more strongly with ethylene oxide than with HCN, despite the generally lower sorption of the former. Sorption increased with moisture content more rapidly at higher than at lower levels. Analysis showed that changes in the concentration-time products associated with differences of moisture content were insufficient to account for the variation of the residual fumigant. Sorption on damp wheat was so heavy that further fumigant moved into the sack to replace that sorbed, and was itself sorbed, to an extent that more than accounted for the initial interstitial dosage.

Fortescue-Foulkes (J.). **Seasonal Breeding and Migrations of the Desert Locust** (*Schistocerca gregaria* **Forskål**) **in south-western Asia.**—*Anti-Locust Mem.* no. 5, 35 pp., 1 fig., 14 maps (2 fldg.), 35 refs. London, 1953.

This fourth and final paper in a series dealing with the seasonal breeding and migration of *Schistocerca gregaria* (Forsk.) in different parts of its range [*cf. R.A.E.*, A **40** 321, etc.] comprises an account of its activity in India north of 20°N. lat., Pakistan, Persia, Afghanistan and the south of Soviet Central Asia. It is based largely, though not exclusively, on the records of the Anti-Locust Research Centre for the outbreak of 1940–47, and also includes information on the topography and climate of the area and a description of the methods of analysis, which resembled those used for the other regions.

The following is partly based on the author's summary. Three different breeding seasons were distinguished, during each of which are produced one or two generations of swarms that may follow a general pattern of migrations from one breeding area to another. During the south-west monsoon in June–October, swarms breed in northern and north-western India and in Pakistan, giving rise to one or two generations. Towards the close of the rainy season, swarms of these generations may migrate west or north-west into areas of winter rain, reaching southern Persia and, sometimes, the Oman, where they breed during October–February and give rise to the winter and early-spring generation. There may also be an easterly migration during September–November that occasionally extends as far as Bihar and Assam. From January, surviving swarms of the monsoon generations and swarms of the winter and early-spring generation become involved in a northward and westward movement in Persia, Punjab and the extreme north-west of India, during which they may breed and give rise to one or two main spring generations that hatch between late March and July. From these breeding areas, the spring swarms return in southerly and easterly directions to the monsoon breeding areas and in doing so may extend over the whole of northern India; there may at first be a northerly movement from Persia, however, as a result of which swarms may enter Afghanistan and parts of Soviet Central Asia. It is thus possible for five generations to be produced in the year in south-western Asia, as in north-eastern Africa and the Middle East [**40** 321]. Whether they all develop depends on climatic conditions and the continuity of swarm displacements between the seasonal breeding areas.

Cotterell (G. S.). **Notes on Insect Injuries to Crops in Afghanistan.**—*FAO Plant Prot. Bull.* **2** no. 4 pp. 53–55, 1 ref. Rome, 1954.

In this paper, which is based on observations in 1952–53 and supplements an earlier one on insect pests in Afghanistan [*R.A.E.*, A **41** 285], it is reported that outbreaks of *Pseudaletia* (*Cirphis*) *unipuncta* (Haw.) were widespread on wheat throughout the Kabul plateau in the spring of 1953. In general, the attack developed too late to affect the yield, but in some areas there was a reduction of 10 per cent. *Chilo zonellus* (Swinh.) was common on maize in Eastern Province and infested up to 20 per cent. of the plants in the Laghman valley. In the same area, *Schoenobius bipunctifer* (Wlk.) (*incertellus* (Wlk.)) attacked 30 per cent. of the stems of rice in some fields; losses were heavy when the attack occurred during the flowering stage, as it prevented the formation of heads and grain and delayed tillering. A species of *Argyria* boring in the stems and *Emmalocera depressella* (Swinh.) boring in the roots of sugar-cane caused losses amounting to 1 per cent. of the canes in some parts of the Province. A red perennial variety showed some resistance to attack, but enabled the pests to carry over the winter. Local but often severe outbreaks of *Pyrilla* sp. caused wilting of the leaves. Sporadic infestation by *Heliothis armigera* (Hb.) occurred on cotton in Kataghan Province, in the north-east.

Adults of *Cydia* (*Carpocapsa*) *pomonella* (L.) [*cf. loc. cit.*] emerge during March–April, and there are two or three generations a year on apple. Deciduous fruits and shade trees at a place in Southern Province were defoliated by *Euproctis signata* (Blanch.), the eggs of which were deposited on the lower surface of the leaves in June–July, and the shoots of deciduous fruit trees were everywhere attacked by a species of *Eulecanium* (*Lecanium*), especially where irrigation water was not plentiful. *Citrus* in Eastern Province was infested by *Aonidiella aurantii* (Mask.), a Coccid thought to belong to the genus *Saissetia* that attacks the shoots. *Phyllocnistis* sp., which mines the leaves and seriously retards the growth of seedlings, and an unidentified Cerambycid that causes considerable damage to the trunks and main branches of very old sour-orange trees.

Grain stored in bulk in the warmer parts of the country was often seriously damaged by *Trogoderma granarium* Everts, which was largely confined to wheat and barley, and *Rhizopertha dominica* (F.) and *Calandra* (*Sitophilus*) *oryzae* (L.), which also attacked rice and maize. These insects cannot survive the winter in the colder regions.

Miller (P. R.). **Detection of Virus B of Chrysanthemum in the United States.**—*FAO Plant Prot. Bull.* **2** no. 4 pp. 56–59, 3 refs. Rome, 1954.

Prior to 1952, the virus diseases known to infect chrysanthemum in the United States were tomato spotted wilt, aster yellows, chrysanthemum stunt, two types of mosaic and tomato aspermy [*R.A.E.*, A **38** 148]. In that year, a serious increase in virus disease of chrysanthemum was reported in Holland following the introduction of new varieties from the United States and Britain. One that was frequent in Holland and was referred to as a chrysanthemum strain of cucumber mosaic was evidently identical with tomato aspermy, and the causal agents of the others were designated chrysanthemum viruses B and C. Virus B produced local yellow lesions in petunia but, unlike the virus of tomato aspermy, caused no systemic symptoms in that plant and did not infect tobacco, tomato or *Physalis angulata*; other plants infected by it were snapdragon [*Antirrhinum*], *Calendula*, China aster [*Callistephus*], *Nicotiana glutinosa* and *Helichrysum bracteatum*. As virus B was not known to occur in the United States, inoculation experiments with chrysanthemum plants of 60 stocks of known

and unknown virus content were carried out there in February 1953, tobacco, *Physalis*, and petunia being used as the test plants. Tomato aspermy was recovered from only seven stocks, and virus B from 17; the former produced systemic veining and mottling on petunia after six days and on tobacco and *Physalis* after eight, whereas the latter produced local yellow lesions in petunia after 14–21 days. Virus B was found to be present in chrysanthemum plants of the variety Nightingale maintained as a stock source of aspermy virus and in two other varieties maintained as a stock source of Q virus, which was recently described by Keller as the causal organism of one of the types of chrysanthemum mosaic. When plants of one of the source varieties for Q virus were infected from the variety Nightingale by grafting, by means of Aphids and by sap inoculation, they developed a diffuse, often patchy, dull yellowish mottling without leaf distortion, but when infected by sap inoculation with pure aspermy virus from tobacco or *Physalis*, plants of this variety and of five others developed no symptoms, though the virus was recoverable from them; the mottling, which had hitherto been ascribed to the aspermy virus, was therefore caused by virus B. Two chrysanthemum varieties from England and one from Denmark were also found to be infected with both aspermy and virus B.

Aspermy virus probably causes no significant damage to chrysanthemum in the United States, where the flower distortion associated with it in Europe has not been observed, and it is not known to be widely prevalent. It infects tomato, tobacco, lettuce, spinach, pepper [*Capsicum*] and a number of ornamental plants, however, and as a precaution against its accidental dissemination, it is pointed out that scions from infected plants of some varieties of chrysanthemum do not infect test plants on to which they are grafted until 9–11 months have elapsed.

In experiments on Aphid transmission, *Macrosiphum* (*Macrosiphoniella*) *sanborni* Gill., *Macrosiphum* (*Myzus*) *solani* (Kalt.), *Myzus persicae* (Sulz.) and *Rhopalosiphum rufomaculatum* (Wils.) all transmitted virus B from infected to healthy chrysanthemum. *M. persicae* transmitted aspermy from chrysanthemum and tobacco to tomato; *Macrosiphum sanborni*, *M. solani* and *Myzus persicae* all transmitted it from chrysanthemum to tobacco, and the last two transmitted it from infected to healthy tomato and tobacco. No transmission of either virus was obtained with *Anuraphis padi* (L.) (*helichrysi* (Kalt.)) or *Aphis gossypii* Glov.

It is uncertain whether virus B, which is common in the United States, is to be regarded as a mild form of Q virus or whether Q virus is a complex of which virus B is a constituent.

Outbreaks and new Records.—*FAO Plant Prot. Bull.* **2** no. 4 pp. 60–62. Rome, 1954.

New records reported from Netherlands New Guinea by H. W. Moll (p. 61) comprise *Hercothrips* (*Heliothrips*) *striatopterus* (Kobus) and *Peregrinus* sp., both of which damaged maize in the Merauke sub-district of South New Guinea during September and October 1953.

VAN DER VECHT (J.). **Het *Lantana*-wantsje in Indonesië** (*Teleonemia scrupulosa* **Stål, Fam. Tingidae**). [The Lantana Bug (*T. scrupulosa*) in Indonesia.]—*Tijdschr. PlZiekt.* **59** pt. 5 pp. 170–173, 9 refs. Wageningen, 1953. (With a Summary in English.)

Teleonemia scrupulosa Stål was imported into Java from Australia in 1939 and reared in the laboratory at Bogor with a view to its release on

Timor island against *Lantana camara*, which is a nuisance there in pastures. It was not released, however, because *Lantana* is useful in preventing soil erosion on mountain slopes, and the laboratory stock was destroyed in 1940. Some examples must have escaped, however, as the Tingid has been recovered from several localities in and around Bogor since 1951. The climate in this locality is moist and unfavourable to the bug, but the influence of the latter on *Lantana* will be observed with interest as it spreads to drier areas with a climate comparable with that of Timor.

Betrem (J. G.). **Het optreden van plaatselijke rassen bij** *Helopeltis antonii* **Sign. op Java.** [The Occurrence of local Races of *H. antonii* in Java.]—*Tijdschr. PlZiekt.* **59** pt. 5 pp. 174–177, 1 graph, 4 refs. Wageningen, 1953. (With a Summary in English.)

In tests in Central Java in 1939–40 in which *Helopeltis antonii* Sign. was reared in the laboratory at constant temperatures, the nymphs all died at 11·5, 16·5 or 35°C. [52·7, 61·7 or 95°F.] and reached the adult stage in averages varying from 30·8 and 32·8 days for males and females, respectively, at 20°C. [68°F.] to 14·3 and 14·6 at 25·5°C. [77·9°F.] and 11 and 13·5 at 31·5°C. [88·7°F.]. These periods were much longer than those recorded by Zehntner (1901) for *H. antonii* on cacao, and although there was considerable agreement with the figures given by Leefmans for nymphs on tea at 25°C. [87°F.], his examples developed in 19 days at 19°C. [65·2°F.]. Further investigations showed that the strain used was well adapted to the average temperature of the estate from which it originated. A similarly high degree of adaptation to local conditions is probable in other areas, and it is considered likely that populations of *H. antonii* in different localities do not have the same genetic composition. *Helopeltis* is known to form biological races readily, and although tea is heavily infested in West Java, it is not attacked in Central Java, even where the bugs are present on *Crotalaria* growing in the plantations. The occurrence of *H. bradyi* Waterh., which has been considered a variety of *H. antonii* and is found only at high altitudes [*cf. R.A.E.*, A **5** 132], can probably be explained in the same way, and it is therefore considered by the author as a subspecies of *H. antonii*.

Less is known of the racial composition of *H. theivora* Waterh., which infests tea and cacao but is not uniformly distributed in Java. Examples of *H. theobromae* Miller from Malaya [*cf.* **28** 229] were almost identical with *H. theivora* from Central Java and *theobromae* is therefore considered to be a subspecies of *H. theivora*.

Franssen (C. J. H.), Nijveldt (W.) & Tjoa Tjien Mo. **Een voor spaanse peper schadelijke galmug.** [A Gall-midge injurious to Peppers.]—*Tijdschr. PlZiekt.* **59** pt. 5 pp. 178–180, 11 figs., 6 refs. Wageningen, 1953. (With a Summary in English.)

The adults of *Asphondylia capsici* Barnes are described, and it is stated that peppers [*Capsicum*] are infested by this Cecidomyiid in Java. Fruits attacked at an early stage of development remain small, whereas those attacked later are distorted into a spiral.

Geijskes (D. C.). **Nuptial Flighttime of** *Atta*-**Ants in Surinam.**—*Tijdschr. PlZiekt.* **59** pt. 5 pp. 181–184, 2 graphs, 7 refs. Wageningen, 1953. (With a Summary in Dutch.)

Investigations on the development of sexual forms and the seasonal occurrence of nuptial flights of the leaf-cutting ants, *Atta cephalotes* (L.)

and *A. sexdens* (L.), were made in Dutch Guiana with a view to finding the best time for carrying out chemical control measures. Samples of fresh fungus-gardens were collected from one nest of each species every month from July 1940 to August 1941, the ants killed with carbon bisulphide, and the winged males and females and the sexual larvae and pupae counted. The results are shown on graphs. Sexual forms of *A. cephalotes* were present from the end of November to June and of *A. sexdens* from the end of October until April. Both colonies at first gave rise to a few females followed by a sudden large number of males. Others were observed in which females predominated. In the two examined, the numbers of sexual forms rose sharply, the culminating periods and times of nuptial flight being May for *A. cephalotes* and January for *A. sexdens*. In each case, flight occurred during one of the rainy seasons, and dispersal of the ants could be prevented by applying control measures [*cf. R.A.E.*, A **29** 169] in the preceding dry season, February–April for *A. cephalotes* and September–November for *A. sexdens*.

Wilkes (A.) & Wishart (G.). **Studies on Parasites of Root Maggots (*Hylemya* spp.; Diptera: Anthomyiidae) in the Netherlands in Relation to their Control in Canada.**—*Tijdschr. PlZiekt.* **59** pt. 5 pp. 185–188, 2 refs. Wageningen, 1953.

Hylemyia brassicae (Bch.) and *H. floralis* (Fall.) are serious pests of cruciferous crops in Canada, and damage by them has increased in recent years. *H. cilicrura* (Rond.) is of minor importance on crucifers, though widely distributed. Insecticides give effective control on cabbage, cauliflower and radish [*cf. R.A.E.*, A **40** 302], but no satisfactory treatment has been developed for swedes, which are being produced in increasing quantities for human consumption. Since it is assumed that *Hylemyia* spp. were originally introduced from Europe, a preliminary survey of natural enemies in the north-west of that continent was undertaken in 1950, followed by more detailed investigations in Holland in 1951, the results of which are given. About 17,000 puparia of *H. brassicae* and *H. cilicrura* were collected from 14 localities, shipped to Canada, and observed for emergence of flies or other insects. *H. brassicae* proved to be the commoner of the two species, and constituted over 95 per cent. of the population in most areas. The most important of the natural enemies were the Staphylinids, *Aleochara bilineata* Gylh. [*cf.* **42** 170] and *A. bipustulata* (L.), and the Cynipid, *Trybliographa rapae* (Westw.). The average percentage attack on *H. brassicae* was 31, but some of that by *Aleochara* spp. was probably missed as they enter the puparia in the ground at any time [*cf.* **37** 141] and some of those collected may have been only recently formed. All three species are present in eastern Canada and are about as effective there as in Holland. Two other parasites found in small numbers were *Phygadeuon* sp. and *Aphaereta* sp., and their possible usefulness in Canada is being investigated.

Hering (E. M.). *Agromyza nigrociliata* **Hendel als Getreideschädling (Dipt.).** [*A. nigrociliata* as a Pest of Cereals.]—*Tijdschr. PlZiekt.* **59** pt. 5 pp. 188–191, 3 figs. Wageningen, 1953.

An outbreak of *Agromyza nigrociliata* Hendel was observed on wheat and rye in mid-June near Görlitz, in eastern Germany. The larvae appeared in the first half of June and mined in the lower leaves of the plants and in wild grasses bordering the fields. In the second half of the month, a

second batch of larvae was observed in the upper leaves, particularly those of wheat. The eggs were deposited in the leaf tissue at some distance from the tip, and several larvae not infrequently developed in the same leaf. When full-fed, they left through the upper surface and pupated in the soil. There was only one generation a year, the adults emerging in spring. Injury to the lower leaves was of no importance, but heavy infestation of the upper leaves reduced the yield. Characters are given distinguishing the adults, larvae and mines from those of *A. niveipennis* Zett., which are very similar. *A. nigrociliata* was described from Vienna and Hungary. It was also reared by the author from material from Berlin and Kassel, and is further recorded from Sweden, where it has hitherto been misidentified. Its life-history was previously unknown.

DE FLUITER (H. J.) & VAN DER MEER (F. A.). *Rubus* **Stunt, a Leafhopper-borne Virus Disease.**—*Tijdschr. PlZiekt.* **59** pt. 5 pp. 195–197, 1 pl., 6 refs. Wageningen, 1953. (With a Summary in Dutch.)

A virus disease that causes dwarfing of *Rubus* and the production of weak, non-fruiting canes was described from Britain by Prentice in 1950 and has been prevalent since 1945 on wild and cultivated raspberries and wild blackberries in Holland. In tests begun there in 1950, no transmission was effected by Aphids that are known vectors of other raspberry viruses, but when about 20 examples of the Jassid, *Macropsis fuscula* (Zett.), from diseased *R. odoratus* were transferred in July 1952 to three healthy raspberry plants in an insect-free glasshouse, typical symptoms of the disease were observed on all three in June 1953. *M. fuscula* overwinters on *Rubus* in the egg stage, feeds on the plants in spring and summer and apparently has one generation a year. It was rather common on the diseased plants.

VAN MARLE (G. S.). **Een interessante waarneming over het schadelijk optreden van de zuringbladwesp** (*Ametastegia glabrata* **Fall.**). [An interesting Observation on a Case of Damage by *A. glabrata*.]—*Tijdschr. PlZiekt.* **59** pt. 5 pp. 205–206, 2 refs. Wageningen, 1953. (With a Summary in English.)

Serious injury to apples in Holland by larvae of *Ametastegia glabrata* (Fall.) was observed in the autumn of 1952 in a part of a bush-orchard with a cover-crop of vetch [*Vicia*] but not in parts with an under-crop of potatoes. The difference was attributed to the presence in the vetch of the weed, *Polygonum convolvulus*, which is a known food-plant of the sawfly larvae and had grown up into the trees.

LANGENBUCH (R.). **Über den Einfluss des Lösungsmittels auf die insektizide Wirkung des Lindans.** [On the Influence of the Solvent on the insecticidal Effect of Lindane.]—*Z. PflKrankh.* **60** pt. 4 pp. 167–181, 7 figs., 19 refs. Ludwigsburg, 1953. (With a Summary in English.)

As previous work by the author showed that γ BHC was less toxic in olive oil than in an aqueous suspension when administered orally to *Periplaneta americana* (L.) or topically to house-flies (*Musca domestica* L.), further experiments were carried out on the influence of solvents on toxicity. In the first, standard amounts of 0·03 per cent. solutions of γ BHC were applied topically to the proboscis and antennae of anaesthetised females of *M. domestica* that were ready to oviposit (since these had been found to

be more resistant to insecticides than young females or males), and knockdown was recorded at intervals of 15 minutes for up to 12 hours. Knockdown was complete within two hours when the solvent was ethanol, acetone or glycerol, and not complete in 12 hours when it was benzine, diesel oil, olive oil alone or with acetone (1:1), kerosene, castor oil, Turkey red oil (sulphonated castor oil), a polyoxyethylene-sorbitan ester, or cod-liver oil. When the flies were confined for 12 hours on filter papers impregnated with the solutions, knockdown was complete in 135 minutes or less with acetone, benzine and glycerol and in 225 minutes with diesel oil, and not complete in 12 hours with kerosene, olive oil, cod-liver oil and the sorbitan ester. When 0·015 per cent. solutions were fed to females of *Leptinotarsa decemlineata* (Say) by a sandwich method, acetone and glycerol solutions gave complete knockdown in about two and four hours, and solutions in kerosene, diesel oil, olive oil and sorbitan ester did not do so in 24 hours.

Ethanol, acetone and glycerol are classed as effective solvents, and the others as ineffective. Ethanol and acetone are volatile, and the solutions left minute droplets of BHC on glass that solidified on disturbance without altering their shape. Glycerol, which is not volatile, and the ineffective solvents formed solutions that persisted for considerable periods; even benzine, despite its volatility, did not evaporate completely, but left a fine film that maintained the BHC in solution.

No relation could be found between the effectiveness of the solutions in the non-volatile solvents and the ability of the latter to penetrate a film of beeswax (representing the insect cuticle), glycerol for example not penetrating at all, and miscibility with water was obviously not a factor, since glycerol, which was effective, and Turkey red oil and the sorbitan ester, which were not, are all miscible with it.

The solubility of γ BHC in the non-volatile solvents was then studied; it was very low (0·06 per cent.) in glycerol, and much higher (1·5–12 per cent.) in the ineffective solvents. According to Nernst's partition law, two non-miscible solvents in contact with each other will dissolve a third substance in proportion to its solubilities in them, so that the concentrations in the two remain in a constant ratio irrespective of actual concentration level. It follows that the concentration obtained in the water phase of the insect (the haemolymph and the organs and tissues, such as the nerves, pervaded by it) varies inversely with the solubility of the insecticide in the solvent, so that a toxic dose may not be received if the insecticide is highly soluble in the solvent. Toxicity increases as the ratio of the concentration used to the saturation concentration rises to unity, and in the first experiment this ratio was 0·0025 for the sorbitan ester, 0·0033 for olive oil and 0·0075 for diesel oil, which gave 22, 30 and 58 per cent. knockdown in 12 hours, respectively, and 0·5 for glycerol, which gave complete knockdown in 1·75 hours. When the concentrations of the various solutions were adjusted to 50 per cent. of saturation, all gave complete knockdown of flies within two hours by topical application. The benzine solution was the most rapid in action, and this is attributed to the formation, as the benzine evaporated, of very fine droplets of BHC, that solidified on disturbance. The BHC crystals left by the acetone were coarse and less effective than fine ones.

The applicability of the partition law was further accidentally shown by the finding that the addition of an emulsifier to a half-saturated solution of γ BHC in glycerol, to improve its wetting properties, reduced its toxicity unless the emulsifier was also half-saturated with BHC.

The partition law applies only to solvents that are not miscible with each other, and the miscibility of glycerol with water might be considered an objection to the application of this law to the case of an insect treated with a glycerol solution. Both pyrethrins and DDT have been shown to

penetrate the insect integument chiefly by way of the epicuticle covering the sense organs [*R.A.E.*, A **24** 455; **37** 115], and there is no evidence that γ BHC differs from DDT in this respect, solutions of the two in olive oil proving equally less toxic than solutions in acetone. If this is so, the solution comes into contact, not with the water phase, but with the lipoids of the epicuticle, so that the law still applies.

Mühlmann (H.). **Ein Versuch zur Klärung der Resistenz der Wintereier von** *Paratetranychus pilosus* **C.u.F. gegen Winterspritzmittel.** [An Attempt to explain the Resistance of Winter Eggs of *P. pilosus* to Winter Sprays.]—*Z. PflKrankh.* **60** pt. 4 pp. 181–182, 2 figs. Ludwigsburg, 1953.

The winter eggs of *Paratetranychus pilosus* (C. & F.) are resistant to sprays, and the author records observations showing that the yolk of these eggs is surrounded by a membrane that is largely separated from the chorion by an air-space. This is deemed to protect the embryo from toxicants penetrating the shell and also from asphyxiation in eggs sprayed with oil.

Salas F. (L. A.). **Una nota sobre** *Heliothis virescens* **(F.) como insecto del algodonero en Venezuela.** [A Note on *H. virescens* as a Pest of Cotton in Venezuela.]—*Agron. trop.* **1** no. 1 pp. 67–69, 7 refs. Maracay, 1951. (With a Summary in English.)

In October 1950, a larva of *Heliothis virescens* (F.) was found to have destroyed all the flower buds on a young cotton plant in the State of Portuguesa, this being the first record of the pest infesting cotton in Venezuela, although it is known to attack other plants there. Its distribution on cotton is reviewed from a paper already noticed [*R.A.E.*, A **33** 278].

Box (H. E.) & Pontis Videla (R. E.). **Apuntes sobre el hongo entomógeno** *Beauveria bassiana* **(Mont.) Vuill., parásito de** *Diatraea* **en Venezuela.** [Notes on the entomogenous Fungus, *B. bassiana*, a Parasite of *Diatraea* in Venezuela.]—*Agron. trop.* **1** no. 3 pp. 233–236, 1 fig., 1 ref. Maracay [?1952]. (With a Summary in English.)

During studies in Venezuela in 1941–50, larvae and pupae of six species and one subspecies of *Diatraea* were found to have been attacked by the entomogenous fungus, *Beauveria bassiana*, which had not been previously recorded from that country. The species concerned, a list of which is given, showing the localities in which they were taken and their food-plants, included *D. busckella busckella* Dyar & Heinr., *D. canella* Hmps., *D. rosa* Heinr. and *D. saccharalis* (F.) on sugar-cane. Experiments on artificial infestation were made in the laboratory with spore suspensions prepared from a culture of the fungus isolated from dead larvae. Within ten days, all of five larvae of *D. rosa* that had been sprayed with a suspension and placed on pieces of sugar-cane had died showing symptoms resembling those observed in the field, and four of five placed on pieces of cane that had been sprayed with the suspension had also died, the fifth pupating normally. There was no mortality in the controls. In further experiments, pieces of cane were sprayed with suspensions of 5 and 30 mg. spores in 40 cc. water, and 40 larvae of *D. canella* were exposed to each concentration three hours later. After ten days, 23 and 19 larvae, respectively, were dead. When the stronger suspension was applied to 80 larvae of *Laphygma*

frugiperda (S. & A.), only four became infested in ten days. Attack was commonest in the field in the dry season, from December to March. Species of *Paratheresia* and *Metagonistylum* that parasitise *Diatraea* spp. were not attacked by the fungus in the laboratory.

Szumkowski (W.). **El algodón de sabana,** *Cienfuegosia affinis* **(H.B.K.) Kochr., huésped del picudo del algodón,** *Anthonomus grandis* **Boh. en Venezuela.** [*C. affinis*, a Food-plant of *A. grandis* in Venezuela.]—*Agron. trop.* **1** no. 4 pp. 279–286, 6 figs., 5 refs. Maracay, 1952. (With a Summary in English.) *Cienfuegosia affinis* **(H.B.K.) Kochr.** (*Hibiscus sulphureus* **H.B.K.) malvácea silvestre, hospedera de insectos dañinos del algodonero en Venezuela.** [*C. affinis*, a wild malvaceous Food-plant of Insect Pests of Cotton in Venezuela.]—*Op. cit.* **3** no. 1 pp. 3–12, 6 figs., 1 map, 13 refs. 1953. (With a Summary in English.) **Nota preliminar sobre** *Cienfuegosia heterophylla* **Garcke, planta hospedera de** *Alabama argillacea* **(Hbn.) y** *Anthonomus grandis* **Boh. en Venezuela.** [A preliminary Note on *C. heterophylla*, a Food-plant of *Alabama argillacea* and *Anthonomus grandis* in Venezuela.]—*T.c.* no. 2 p. 121.

In the first of these papers, it is stated that in Venezuela, where *Anthonomus grandis* Boh. was recorded for the first time on cotton in 1949 [*R.A.E.*, A **41** 325], this weevil develops continuously throughout the year, and an account is given of observations in 1950 to discover the food-plants attacked between February and July, when cotton is not available. Various indigenous malvaceous plants, the most numerous being *Cienfuegosia affinis* (of which *Hibiscus sulphureus* [*cf. loc. cit.*] is stated to be a synonym), were sown in an experimental plot surrounded by infested cotton. All stages of the weevil were later found on the buds, flowers and bolls of *C. affinis* in considerable numbers, especially in November, up to four adults being found in the same flower. Investigations in northern Venezuela in 1950–51 showed that *C. affinis*, which grows wild and is abundant in many parts of the country, was infested by the weevil in three States. Eggs were laid in the buds or green bolls and in the bracts of open flowers, and the larvae developed at the base of the flowers or attacked the seeds in the bolls. The adults fed on the buds, flowers and bolls, and examples caged on *C. affinis* survived for 20–177 days, with an average of 102, the corresponding figures for cotton being 26–155 and 115.

In the second paper, the author summarises the information contained in the first and states that two other pests of cotton, *Alabama argillacea* (Hb.) and *Sacadodes pyralis* Dyar, and *Strymon* (*Thecla*) *melinus* Hb., which occasionally attacks the crop, also infest *C. affinis* in Venezuela. *A. argillacea*, which had previously been recorded only from cotton, was found in the field on *C. affinis* in May 1948. Studies in 1949–51 showed that the first adults appear in Venezuela at the end of March or the end of April, though the earliest cotton is not sown until the second half of June or later, by which time 2–3 generations of *A. argillacea* have developed on *C. affinis*. In 1949, the percentage infestation of the plants was 6·6 from 23rd June to 2nd July, 2·9 on 3rd–5th August, 1·5 on 15th–17th August and 0·3 on 1st–6th September, showing that *C. affinis* is a constant source of infestation for cotton. Development on it was normal in the laboratory. In view of this, it is recommended that treatment be applied to cotton only when infestation is severe. As *C. affinis* is said to occur from Colombia to Brazil and Paraguay, it may be an important factor in the spread of the pest in South America. *Sacadodes pyralis* was first found on the plant in late 1950, and in the following year [*cf.* **42** 173] up to 20 per cent. of the bolls

and 4 per cent. of the flower buds were found to be infested with eggs and small and medium-sized larvae. Mortality was high during rearing in the laboratory, since the buds and bolls were too small for the large larvae to penetrate and the flowers did not last.

It is reported in the third paper that immature stages of *A. argillacea* and adults of *Anthonomus grandis* were taken on *Cienfuegosia heterophylla* in the State of Anzoátegui in July 1953, thus confirming the results obtained in the laboratory in 1952, when *Alabama* was successfully reared on this plant. Adults of *Anthonomus* that fed on the buds and flowers survived for an average of 69 and a maximum of 134 days, and eggs were freely laid on the buds.

Santa Maria (H. C.). **Acción insecticida directa y sistémica de algunos ésteres del ácido carbámico (uretanos). Antecedentes y experimentación con** *Schizaphis graminum*. [The direct and systemic insecticidal Action of some Esters of Carbamic Acid (Urethanes), their Origins, and Experiments with them against *Toxoptera graminum*.]—*Rev. Fac. Agron. Eva Perón* **29** pt. 2 pp. 181–199, 6 figs., 10 refs. Eva Perón, 1953. (With a Summary in English.)

The author reviews the literature on the composition and toxicity of Dimetan (5,5-dimethyldihydroresorcinol dimethylcarbamate) [*cf. R.A.E.*, A **40** 360], Pyrolan (1-phenyl-3-methyl-pyrazolyl(5) dimethylcarbamate) [**41** 134] and Isolan (1-isopropyl-3-methyl-pyrazolyl(5) dimethylcarbamate) [**41** 400], and gives an account of laboratory experiments in Argentina in which the last two were tested against *Toxoptera* (*Schizaphis*) *graminum* (Rond.) on oat seedlings.

Oat seeds germinated normally in four days after immersion for 15–60 minutes in aqueous solutions of 0·25 or 0·5 per cent. Isolan, but required a further two days after immersion for two hours and did not germinate at all after immersion for 24 hours. The seedlings were each infested with 25 examples of *T. graminum*, and counts made 48 hours later showed only 13 Aphids on five plants from treated seeds, as compared with 280 on the corresponding controls. Mortality was complete after a week for the treated series and only 30–40 per cent. of the leaf surface showed chlorosis due to feeding, as compared with 95 per cent. on the controls, which were being abandoned by the Aphids. The plants were reinfested when 12 days old, and the systemic action had then somewhat diminished, the numbers of Aphids on the test plants after 48 hours being nearly a third of those on the controls. Germination was not affected by immersion for 15–120 minutes in 1 per cent. Isolan. The seedlings were infested when two days old, and complete knockdown occurred in three hours; the plants were reinfested three days later and complete knockdown was recorded after 16 hours, with 70 per cent. mortality. Subsequent reinfestation every five days indicated that the length of time required for the insecticide to take effect increased progressively, until all toxicity was lost when the plants were 35 days old. Seed immersed for 24 hours in 1 per cent. Isolan germinated, and though the plants were inferior, the insecticidal action was greater than for the lower concentrations and was still high after 20 days. Immersion in 2 per cent. Isolan for 60 minutes, and in some cases for 30 minutes only, had phytotoxic effects, though complete mortality of the Aphid was recorded in an hour on plants from seeds treated for 30 minutes. Pyrolan is not soluble in water, and the results obtained by treating the seeds with suspensions of it were inferior to those given by solutions of Isolan.

Other experiments were made to establish that the results obtained by treating the seeds with Isolan were due to translocation in the plants, and not to any fumigant action of traces remaining on the seeds. When leaves were taken from plants grown from seeds immersed in 1 per cent. Isolan for an hour and also from control plants, Aphids placed on the former were affected in three hours, whereas infestation persisted in the latter. When infested seedlings from untreated seeds were enclosed in jars together with open tubes containing 1 cc. 10 per cent. Isolan solution, either inserted into the soil or suspended above the plants, fumigant effects were observed only after 48 and 24 hours, respectively, so that such action was unlikely to have been responsible for the earlier rapid toxicity. When plants from treated seeds were enclosed with control plants, Aphids placed on the former were affected within two hours, whereas those on the latter persisted until the plants died as a result of the infestation. A spray was prepared from the leaves of plants grown from seeds immersed in 1 per cent. Isolan for one hour, and when it was applied to infested plants it gave 80 per cent. knockdown in six hours.

Subsidiary investigations showed that the average weight per seed had increased from 38·9 to 45·64 mg. 24 hours after immersion for an hour in 1 per cent. Isolan. The effect of treatment was not diminished when the seeds were kept in a sealed container for a month before sowing, but there was an appreciable loss of effectiveness after storage for 45 days.

A dust of 1 per cent. Pyrolan applied in a dusting chamber to infested plants at a rate equivalent to 18 lb. per acre gave 90 and 100 per cent. reduction of population after 30 minutes and 24 hours, respectively. A suspension of 0·04 per cent. gave similar results, and when the plants were reinfested after 48 hours, 92 per cent. control was obtained after a further two days. Sprays of Isolan gave complete knockdown in 30 minutes at 0·05 and 0·1 per cent., and 90 and 75 per cent. knockdown, respectively, in 24 hours at 0·005 and 0·001 per cent. In the field, a spray of 0·05 per cent. Isolan gave almost complete control of the Aphids, and plants watered with a solution of 0·1 per cent. Isolan, at the rate of 30 cc. per 175 sq. cm., were free from infestation in 24 hours. There was no mortality on plants in pots placed among treated plants, indicating the absence of fumigant action.

López Cristóbal (U.). **Un parásito cecidógeno del manzano,** *Dasyneura* (*Perrisia*) *mali* **Kieffer (Diptera-Cecidomidae).** [*D. mali*, a Gall-forming Pest of Apple.]—*Rev. Fac. Agron. Eva Perón* **29** pt. 2 pp. 201–205, 1 fig., 6 refs. Eva Perón, 1953.

Dasyneura mali (Kieff.) was observed attacking apple for the first time in Argentina in 1948, in an area along the River Plate near Buenos Aires. All stages are briefly described, and it is stated that the larvae and adults differed slightly from descriptions of this Cecidomyiid in Europe. Observations in November–December 1952 showed that the larvae overwintered in cocoons in the soil at the base of the trees, and that the adults appeared from the middle of spring onwards. The females laid their eggs in groups of up to 18 on the edges of the upper surfaces of the leaves, which then curled towards the mid-rib, forming galls. The larvae hatched in 3–5 days, fed on the affected tissue for about 10 days, during which time the leaves became completely rolled up and discoloured and fell to the ground, and then usually left the leaves and pupated in silken cocoons about 1½–2 ins. below the surface of the soil; pupation occasionally took place in the curled leaves. The pupal stage lasted 2–3 weeks, and the adults survived for

about two weeks in spring and summer. As the adults fly little, successive generations developed on the same trees, and some of these had lost three-quarters of their leaves by the end of spring, which hindered the development of the fruits and left them exposed to the sun. Trees sprayed with lead arsenate against *Cydia* (*Carpocapsa*) *pomonella* (L.) were not damaged by *D. mali*, and a spray of 1·25 lb. wettable DDT per 100 gals. water gave good control. In the laboratory, the incorporation of a dust of 5 per cent. chlordane into the soil in spring before the infestation began proved effective against the emerging adults.

Gallo (D.). **A *Lixophaga diatraeae* no contrôle da broca da cana.** [*L. diatraeae* and the Control of *Diatraea saccharalis*.]—*Solo* **43** pp. 95–100, 1 fig., 8 refs. Piracicaba, 1951.

Metagonistylum minense Tns. and *Paratheresia brasiliensis* Tns. are the chief parasites of *Diatraea saccharalis* (F.) in Brazil [*cf. R.A.E.*, A **35** 169], where this borer causes severe damage to sugar-cane. In 1950, the larviparous Tachinid, *Lixophaga diatraeae* (Tns.), was introduced from Cuba, where it had proved very effective against *D. saccharalis*, and it was found to have a shorter life-cycle than the indigenous parasites. It was reared in the laboratory by a method resembling that used in Cuba [**42** 271], and ten generations were obtained in the course of a year. The period of gestation was 9–12 days, and the larval and pupal stages lasted 10–13 and 11–14 days, respectively, except in May–August, when the pupal stage lasted 14–18 days, the life-cycle averaging 32·5 days at 21·4°C. [70·52°F.] in September–April and 36 days at 16·9°C. [62·42°F.] in May–August. In March–April 1951, 262 adults were released in small plantings of sugar-cane and maize in São Paulo, and the percentage parasitism obtained averaged 28·7.

Scaramuzza (L. C.). **La mosca cubana. Informe sobre la introducción de *Lixophaga diatraeae* Towns., la mosca cubana, para el control biológico del barreno de la caña, en el Perú.** [The Cuban Fly. Report on the Introduction of *L. diatraeae* for the Biological Control of *Diatraea saccharalis* in Peru.]—19 pp., 2 pls., 20 refs. Lima, Com. Prod. Azúc., Soc. nac. Agr., 1952.

In view of the recommendation that a campaign should be undertaken for the biological control of *Diatraea saccharalis* (F.) on sugar-cane in Peru [*R.A.E.*, A **39** 430], the author visited that country in 1951 to investigate the possibilities of using *Lixophaga diatraeae* (Tns.) for the purpose. The bionomics of this Tachinid and the way in which it is reared and released in Cuba [*cf.* **42** 271] are reviewed. Investigations in Peru showed that the parasite was well adapted to local conditions, the period of gestation, the larval stage, the formation of the puparium and the pupal stage lasting 9–11, 6–7, 1 and 10 days, respectively, in the laboratory at an average temperature of 25·4°C. [77·72°F.]. For field release, puparia were obtained from Trinidad, and between late September and the end of October 1951, 922 males and 893 fertilised females were liberated in cane fields over an area of about 700 acres near Trujillo.

In the course of the work, *Trichogramma minutum* Ril., *Ipobracon rimac* Wolc., *Agathis* (*Microdus*) *stigmatera* (Cress.) and *Paratheresia claripalpis* (Wulp) were observed parasitising *D. saccharalis* in the field. Only the last

was of economic importance [*cf.* **39** 430], and the percentage parasitism by it ranged up to 77·7, though it was rather low in ratoon fields, probably owing to the common practice of burning the fields after harvest, which destroys the parasites as well as the borers. The rearing technique adopted for *L. diatraeae* proved suitable for it, the period of gestation, the larval stage, the formation of the puparium and the pupal stage lasting 9–10, 8–9, 1–2 and 21 days, respectively, at 25·4°C. One field-collected larva of *D. saccharalis* that was inoculated with two *Lixophaga* larvae in the laboratory ultimately gave rise to two puparia of *Lixophaga* and two of *Paratheresia*, thus showing that multiple parasitism is possible.

Recommendations are made for the installation of laboratories for the rearing of *L. diatraeae* and *P. claripalpis* at places conveniently situated for subsequent distribution and liberation throughout the chief sugar-growing areas.

Iba (S.), Giannotti (O.) & Salles (J. M.). **Experiências preliminares para o contrôle de *Dyscinetus* sp., praga da batatinha no vale do Paraíba.** [Preliminary Experiments on the Control of *Dyscinetus* sp., a Pest of Potato in the Paraíba Valley.]—*Biológico* **19** no. 11 pp. 191–195, 2 figs., 4 refs. São Paulo, 1953.

Potatoes in the Paraíba valley, Brazil, are severely attacked by the larvae of *Dyscinetus* sp., which damage up to 20–30 per cent. of the tubers. In experiments on the control of this Dynastid, various dusts were applied to the furrows and incorporated into the soil before planting at about 4·6 lb. per acre and castor cake at ten times that rate. The percentage reductions in the total weight of tubers attacked by the larvae were 85 for 3 per cent. aldrin, 80 for 5 per cent. chlordane, 73 for 5 per cent. DDT, 70 for 10 per cent. toxaphene, 64 for 5 per cent. parathion (Rhodiatox), 57 for 1 per cent. lindane [almost pure γ BHC], and 13 for castor cake. There were no phytotoxic effects, and the flavour of the tubers was not affected. All treatments increased the total yield and the yield of high-grade tubers; the latter represented 34·3 per cent. and 37·5 per cent. of the total for no treatment and treatment with castor cake, respectively, and about 50–56 per cent. for the remaining materials, which had evidently controlled other soil insects as well.

Manickavasagar (P.). **The Potato Tuber Moth *Gnorimoschema operculella* (Zeller) (Order Lepidoptera) Family Gelechiidae.**—*Trop. Agriculturist* **109** no. 2 pp. 118–122, 1 fig., 3 refs. Peradeniya, 1953.

In Ceylon, potatoes have been grown on a small scale for 40 years and on a larger scale for two. In November 1951, tubers in storage were attacked by larvae identified as *Gnorimoschema operculella* (Zell.), and the rapid increase of this moth on crops in upland districts during the subsequent year suggested that it had been introduced not more than a year before it was first found. It was present in almost every potato plot, but on no other plant, though it caused severe damage to tobacco in laboratory tests. In captivity, fertilised females oviposited 1–3 days after emergence and deposited 78–172 eggs in 2–4 days. Adults that had paired lived for 6–10 days, and those that had not for 10–28. The eggs were usually deposited singly on the leaves or tubers, and the larvae mined in the leaves, stems or tubers in the field and in tubers in store, leaving the tunnels and spinning a cocoon among débris before pupating. The egg, larval and pupal

stages lasted 4–5, 13–15 and 8–10 days, respectively. In preliminary tests, effective control was given by DDT in sprays in the field and in dusts in storehouses.

Nuorteva (P.) & Reinius (L.). **Incorporation and Spread of C^{14}-labeled oral Secretions of Wheat Bugs in Wheat Kernels.**—*Ann. ent. fenn.* **19** no. 3 pp. 95–104, 8 figs., 21 refs. Helsinki, 1953.

In further investigations in Finland on the way in which cereal bugs injure wheat grains and reduce the baking quality of the flour [*cf. R.A.E.*, A **42** 61], examples of *Dolycoris baccarum* (L.) and *Lygus rugulipennis* Popp. (*pubescens* Reut.) were allowed to feed for 1–4 days on leaves of *Canna indica* rendered radioactive by exposure to light in a chamber containing carbon dioxide prepared from a compound of C^{14}, and then enclosed in bags with wheat ears at various stages of ripeness. Most injured kernels were obtained from the bags containing *L. rugulipennis*. Positive radioautographs were obtained from 16 of these, ten of which had been injured at the milky stage and six at the yellow stage of ripeness. In all of them, radioactivity was distributed over the whole kernel, indicating distribution of oral secretions, and in two it was relatively greater at the feeding point. Of the few kernels injured by *D. baccarum*, seven gave positive radioautographs. Radioactivity was strong at the feeding points, but evidence of spread of oral secretions was found only in two grains injured at a very early stage of ripeness.

The great dilution in radioactivity during transfer from the leaves into the wheat kernels rendered measurement in the kernels difficult, and a Geiger-Müller counter gave unsatisfactory results. The counts for all wheat samples, including the controls, differed significantly from the background, and this is attributed to the presence of the natural potassium isotope K^{40}. On the assumption that C^{14} was present in the carbon of the saliva in the same ratio as in the body, it is calculated that the maximum concentration of possible proteolytic enzymes (containing about 50 per cent. carbon) in the saliva of *D. baccarum* was 1:40,000.

Hartzell (A.), Storrs (E. E.) & Burchfield (H. P.). **Comparison of Chemical and Bioassay Methods for the Determination of Traces of Chlordane and Heptachlor in Food Crops.**—*Contr. Boyce Thompson Inst.* **17** no. 7 pp. 383–396, 1 graph, 6 refs. Yonkers, N.Y., 1954.

The following is based on the authors' summary. Samples of potato, sweet potato, cabbage, onion, carrot, maize and turnip that had been treated with insecticide under field conditions were analysed for chlordane and heptachlor by chemical methods and a bioassay technique [*cf. R.A.E.*, A **42** 76]. Average results obtained by the two techniques agreed closely for the samples containing chlordane, but the bioassay method gave lower results for the heptachlor samples because of the masking effect of plant lipids present in the extracts. Subsequent work showed that heptachlor can be separated from non-volatile lipids by steam distillation.

Correlation between the two methods was significant at the 5 per cent. level when the entire group of 143 samples was considered, but the correlation coefficient was low (+0·219) since the methods were used close to their limits of sensitivity and variations in insecticide content between samples were small. Data on the masking of bioassay results by lipids and plant extracts illustrate the degree of purity that must be achieved by sample-cleaning techniques to obtain satisfactory results.

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